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ALFRED R. C. SELWYN, LL.D., F.R.S., F.G.S., DIRECTOR.

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CONTRIBUTIONS

TO THE

MICRO-PALÆONTOLOGY

OF THE

CAMBRO-SILURIAN ROCKS OF CANADA.

BY ARTHUR H. FOORD, F.G.S.,
ASSISTANT PALÆONTOLOGIST AND ARTIST TO THE SURVEY.

OTTAWA:
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INTRODUCTION.

Before proceeding to the subject of the present memoir some explanation is necessary with reference to that part of it which treats of the Monticuliporidæ. The species referred to are in the Museum of the Canadian Geological and Natural History Survey, and include a fine collection from the vicinity of Ottawa presented by Mr. Walter R. Billings. Much material yet remains to be investigated, and there are some species new to science which require further study before their generic relations can be clearly defined.

The author has followed Mr. E. O. Ulrich's classification and terminology of the Monticuliporidæ, contained in his papers contributed to the Journal of the Cincinnati Society of Natural History.

A list is here given of all the genera of the Monticuliporidæ at present known, descriptions of which are to be found in Mr. Ulrich's papers just referred to.

Family MONTICULIPORIDÆ, *Nicholson.*

Monticulipora, D'Orbigny, (restricted).
Sub-genus *Trematopora*, Hall.
Peronopora, Nicholson.
Homotrypa, Ulrich.
Prasopora, Nicholson and Etheridge.
Diplotrypa, Nicholson.
Monotrypa, Nicholson.
Monotrypella, Ulrich.
Amplexopora, Ulrich.
Stenopora, Lonsdale.
Batostoma, Ulrich.

Batostomella, Ulrich.
Leioclema, Ulrich.
Atactopora, Ulrich.
Callopora, Hall.
Calloporella, Ulrich.
Aspidopora, Ulrich.
Heterotrypa, Nicholson, (restricted).
Dekayia, Edwards and Haime.
Dekayella, Ulrich.
Petigopora, Ulrich.
Nebulipora, (?) McCoy.
Discotrypa, Ulrich.
Spatiopora, Ulrich.
Stellipora, Hall.
Sub-genus *Constellaria*, Dana.

Mr. T. C. Weston, of this Survey, has skilfully prepared the numerous microscopic sections required for the determination of the genera and species. In the study of the various species a Hartnack microscope was used, and the magnified illustrations were made by means of an Oberhaeuser camera lucida. It was found impossible to give satisfactory magnified representations of the surface characters of the Monticuliporidæ, owing to their bad state of preservation.

In conclusion the author desires to acknowledge his obligations to the following gentlemen who have assisted him: Mr. E. O. Ulrich, of Cincinnati, for valuable notes and critical remarks upon many of the species described. Mr. R. Etheridge, jun., and to Dr. H. Alleyne Nicholson, for friendly assistance and advice. Principal Dawson, of Montreal, for the loan of a series of specimens from the Museum of McGill College, and to Mr. Walter R. Billings for the opportunity of examining a large number of specimens collected by him in the neighbourhood of Ottawa City.

OTTAWA, May, 1883. ARTHUR H. FOORD.

DESCRIPTIONS OF SPECIES.

I. *On the Monticuliporidæ of the Chazy, Black River, and Trenton Formations, with descriptions of ten new species.*

MONTICULIPORA, D'Orbigny, (restricted):

"*External Characters.*—Zoarium massive, lobate, laminar, incrusting, and sometimes irregularly frondescent. Surface sometimes smooth, usually tuberculated. Monticules closely approximated, usually conical, often elongated or compressed. Cells small, their diameter varying in different species from $\frac{1}{80}$ to $\frac{1}{130}$ of an inch, polygonal, and with thin walls; generally groups of cells slightly larger than the average are distributed at regular intervals among those of the ordinary size. Not infrequently a few smaller (young?) cells occupy the summits of the monticules, and they may occasionally be detected between the cells occupying the hollow interspaces.

Internal Characters.—Tubes in the "immature" zones, with very thin walls, and crossed by straight or oblique diaphragms; and often there are large cystoid diaphragms present. In the mature zones the walls become very slightly thickened, and small spiniform tubuli can usually be detected; while numerous cystoid diaphragms are always developed in the greater number of the tubes. Immediately above the point of gemmation, the young tube is crossed by numerous straight diaphragms giving it the appearance of an interstitial tube. Subsequently the diaphragms become less crowded, and the young tube assumes the characters of an ordinary cell. The process of gemmation seems to have taken place more especially at certain levels, since tangential sections taken at different heights may show in one comparatively numerous small tubes, intercalated among the ordinary cells, while another may show but few or none of them. Trenton and Cincinnati." (E. O. Ulrich, Journ. Cincinnati Soc. of Nat. Hist., Vol. V., p. 232, 1882.)

MONTICULIPORA WESTONI. (N. Sp.)

Plate I., figs. 1, 1*a*, 1*b*.

Zoarium irregularly hemispherical. The only specimen collected, which is very imperfect, measures from 20 to 25 mm. in its greatest diameter, and about 15 mm. in thickness. Surface studded with small and inconspicuous monticules. Cells of one kind only. Cell apertures polygonal, but very irregular in outline; about five are contained in the space of 1 mm.

In a tangential section the cell walls appear moderately thick, with numerous and conspicuous spiniform tubuli embedded in them. Wherever the spiniform tubuli occur the walls are inflated, so as to make them appear alternately swollen and constricted.

Owing to the highly crystalline condition of the specimen from which the species is described, the longitudinal section does not show satisfactorily this part of the structure of the fossil. The tubes, however, are seen to be traversed for a portion of their course by straight or slightly curved diaphragms, and in other places the characteristic cystoid diaphragms are developed.

This species is allied to *Monticulipora mammulata*, D'Orbigny, the type of the genus; but in *M. Westoni* the cystoid diaphragms are not so numerous, nor are they arranged in a regular series, and the smaller tubes which occur in *M. mammulata* are wanting.

Locality and Formation.—Ottawa City. Trenton Formation.

Collector.—T. C. Weston, after whom the species is named.

MONTICULIPORA BILLINGSI. (N. Sp.)

Plate I., figs. 2-2c.

Zoarium incrusting, forming a thin layer about ·5 mm. in thickness. External surface smooth and without monticules. Cells of one kind only; very minute, about five being contained in the space of 1 mm. Cell apertures irregular in outline; walls moderately thick. Spiniform tubuli of small size and few in number occur at the angles of junction of the tube-walls.

Tangential sections show that the zoarium is composed of two kinds of tubes, large and small; the latter are very limited in number and not easily distinguished. Some of the cell apertures of the larger tubes exhibit in the centre, or on one side, of them a perforation, due to their possession of cystoid diaphragms. The smaller tubes occupy the spaces between the larger ones, and are very irregular in size and shape.

Longitudinal sections exhibit the cystoid diaphragms in the larger tubes mostly in their basal portion, as well as straight or slightly curved diaphragms nearer the surface. The smaller tubes are almost indistinguishable from the larger ones. The walls of the tubes project above the surface of the zoarium, so as to present in section a spiniform appearance.

This species may be readily distinguished externally from *Monticulipora Cincinnatiensis*, Nicholson, to which it is most nearly related, by the absence of monticules, which are a marked feature of that species; and internally by the very limited number of interstitial tubes.

Locality and Formation.—Hull, Que., near Ottawa City. Trenton Formation.

Collector.—Walter R. Billings, to whom the species is dedicated.

MONTICULIPORA PARASITICA, Ulrich.

Monticulipora parasitica, Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. v., p. 238, pl. 10, figs. 3, 3a, 1882.

The author is indebted to Mr. Ulrich for the identification of this species.

Locality and Formation.—Ottawa City. Trenton Formation.

Collector.—Walter R. Billings.

HOMOTRYPA, Ulrich.

"*External Characters.*—Zoarium ramose to subfrondescent; surface smooth, or with more or less prominent monticules. Cells circular, ovate or polygonal, with moderately thin walls. At intervals there are groups of larger sized cells, which again sometimes enclose small stellate maculæ, consisting of much smaller, angular cells. The surface extensions of spiniform tubuli may often be observed at the angles of the cells.

"*Internal Characters.*—In the axial portion of the branches or fronds, the tubes are "immature," and may be crossed by straight diaphragms; usually diaphragms are entirely wanting in this region. The tube-walls are excessively thin until they reach the peripheral regions, when they are much thickened, and bend outward to open at the surface. In the peripheral or "mature" portion of the zoarium, the tubes are provided with a series of cystoid diaphragms; the space intervening between their flexuous inner line, and the opposite wall of a tube, is crossed by equally numerous straight diaphragms. The tube-walls are perforated by rather large connecting foramina. In the tuberculated species the spiniform tubuli are numerous, but very small, and not easily recognized, while in the smooth forms they are much larger, and constitute a conspicuous feature in sections. The internal structure of the small tubes, which form the maculæ of some species, is not remarkably different from that of the ordinary tubes. The only difference that I have been able to detect is found in the fact that cystoid diaphragms are but rarely developed in them." Trenton and Cincinnati. (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 210, 1882.)

HOMOTRYPA SIMILIS, (N. Sp.)

Plate II., figs. 2-2*d*.

Zoarium ramose, consisting of small sub-cylindrical, or compressed branches. Branches from 8 to 15 mm. in their greatest diameter. Surface smooth, with groups of larger cells than the average occupying small areas, very slightly raised above the general surface of the zoarium. Of the ordinary sized cells there are about four in the space of 1 mm., of the larger ones, (that is, those occupying the slightly raised portions of the surface), about three. In well preserved specimens the surface projections of the spiniform tubuli may be detected with the aid of a hand lens.

In tangential sections the tubes are seen to be thin walled and polygonal in outline in the axial region, and to become thickened near the surface, where spiniform tubuli are developed at the angles of junction of the cell-walls.

In longitudinal sections the tubes are first parallel to the axis of the zoarium, but as they approach the surface they bend gradually outwards. A moderate number of horizontal, straight, or slightly curved diaphragms, from one-half to two tube diameters apart, intersect the tubes for the greater portion of their length, till on nearing the surface cystoid diaphragms are developed. These diaphragms are conspicuous in tangential sections, in which they appear as straight or curved lines crossing the cell-apertures; sometimes two of these lines are visible in the same cell-aperture, owing to their overlapping each other. The present species is very closely allied to *Homotrypa obliqua*, Ulrich, from which it differs in its smooth surface and more conspicuous spiniform tubuli.

Locality and Formation.—Ottawa City. Trenton Formation.

Collector.—E. Billings.

PRASOPORA, Nicholson and Etheridge, jun.

"Free, or loosely adhering to foreign objects, forming hemispherical masses, or thin expansions, with a wrinkled epitheca covering the lower surface. Tubes cylindrical or prismatic, and having one or both sides lined with cystoid diaphragms. Interstitial tubes often completely isolating the proper zoœcia, and crossed by numerous diaphragms. Spiniform tubuli sometimes nearly absent, in other cases more numerous. Trenton and Cincinnati." (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 153, 1882.)

PRASOPORA OCULATA. (N. Sp.)

Plate III., figs. 1-1*g*.

Zoarium free, or attached, discoid, concavo-convex, sharp edged in the immature state, more or less obtuse in the adult; varying, in the four specimens examined, from 15 to 30 mm. in diameter, and from 2·5 to 3·5 mm. in thickness in the centre. Under surface covered with a thin smooth epitheca, which exhibits in a young example two or three concentric wrinkles. Upper surface conspicuously marked with irregularly rounded, or sub-polygonal depressions, generally a little less than their own diameter apart. In the centre of each of these depressions there is a small somewhat compressed elevation slightly raised (as seen in profile) above the surface of the zoarium. The latter is made up of two kinds of tubes, the larger of which can be seen with a hand-lens on a well-preserved specimen. The smaller series of tubes which fill up the spaces between the larger ones can only be discerned in microscopic sections. Of the larger tubes some exceed the average in size, and appear to occupy the depressed areas of the surface of the zoarium; from three to four of them are contained in the space of 1 mm., while from four to five of the smaller or average sized cell-apertures fill a like space.

Tangential sections show the larger tubes to be irregularly circular, or polygonal in outline, and usually completely isolated from each other by the smaller tubes. These latter are angular or sub-angular in form, and variable in size; here and there clusters of them form stellate groups or maculæ surrounded by a set of tubes larger than the average; among the latter but few of the smaller sized angular tubes penetrate, so that in many places their walls are completely in contact, leaving only small interspaces at their angles occupied by the smaller angular tubes. The little elevations situated in the centre of the depressed areas appear to be made up of the last named tubes.

In longitudinal sections this species exhibits remarkable characters. The larger tubes are furnished with cystoid diaphragms which are alternate in their arrangement on either side of the visceral chambers; these diaphragms are usually of a conical form, and sometimes narrow and pointed, they vary much in their distance from each other; in some places they are separated by a space equal to a tube-diameter, in others they are closely approximated; occasionally a straight diaphragm unites them with the opposite wall of the tube. There are a few straight horizontal diaphragms crossing the tubes from side to side. The smaller tubes are crossed by very numerous and close set horizontal diaphragms.

Its remarkable external characters render this an easily recognized species, and serve to distinguish it from its nearest ally *Prasopora affinis*, next described.

Locality and Formation.—Somewhat rare in the Trenton Formation of Ottawa City.

Collectors.—E. Billings, T. C. Weston and Walter R. Billings.

PRASOPORA AFFINIS. (N. Sp.)

Plate III., figs. 2-2*c*.

Zoarium discoid, concavo-convex, about 20 mm. in diameter, and about 2·5 mm. in thickness in the centre. Upper surface, showing the cell-apertures, gently convex, and quite destitute of monticules. Where the surface is well preserved the cell-apertures are seen to be polygonal; groups of from fifteen to twenty cells, larger than the average, may also be detected with the aid of a hand-lens. Of the larger cells, from two and a-half to three are contained in the space of 1 mm., and of the smaller ones about four.

We find in tangential sections that the large tubes, which are sub-polygonal or rounded in outline, have their interspaces filled with the smaller tubes; these are angular in outline, and consist of only one row of cells around each of the larger tubes, which they do not always completely encircle, the larger tubes being sometimes in contact at limited points of their circumference.

Longitudinal sections exhibit a very symmetrical arrangement of the two sets of tubes. The larger of these are filled with conical cystoid diaphragms throughout their entire length, (very similar to those of *P. oculata*), these are alternate in their arrangement on each side of the visceral chambers, and are sometimes joined to the opposite wall by a straight diaphragm, and sometimes the latter running in an oblique direction downwards or upwards, unite together two of the cystoid diaphragms situated on opposite sides of the tube. Very rarely a straight diaphragm crosses the visceral chamber from side to side. The smaller tubes have numerous complete and horizontal diaphragms, and wherever they cross the tubes there is a slight constriction in the walls of the latter. The present species is distinguished from *Prasopora oculata*, (1) by the absence of the surface markings so characteristic of that species; (2) by the fewer number of its small tubes, and their less numerous diaphragms. It may be separated from *P. Selwynii*, Nicholson, by the much smaller size of its zoarium, and by the smaller number of its interstitial tubes, which are not "collected into stellate groups or maculæ."

Locality and Formation.—Ottawa City. Trenton Formation.

Collector.—A. H. Foord.

PRASOPORA SELWYNII, Nicholson.

Monticulipora (Prasopora) Selwynii, Nicholson, "The genus Monticulipora," p. 206, figs. 44 and 45, 1881.

This species is very abundant throughout the Trenton Formation in Canada. It has recently been found also in the upper beds of the Chazy formation, at Nepean, near Ottawa City. It is figured, but not described, by Billings in the "Geology of Canada," (p. 156, fig. 117,) as *Stenopora petropolitana*, Pander.

DIPLOTRYPA, Nicholson.

"Zoarium free, hemispherical. Spiniform tubuli often present, though never numerous.* In other respects like *Prasopora*, excepting that the tubes are provided with straight diaphragms only. Trenton and Niagara." (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 153, 1882.)

DIPLOTRYPA REGULARIS. (N. Sp.)

Plate I., figs. 3-3c.

Zoarium discoid, with attenuated edges, greatest diameter about 20 mm., and from one and a-half to two mm. in thickness in the centre; tubes directed upwards nearly at right angles to the basal plate, and opening upon the surface of the zoarium, which is strongly convex. Surface apparently destitute of monticules. Cells of two kinds; large and small; the former rounded to sub-polygonal in outline; of these there are groups at intervals somewhat larger than the rest, about two in the space of 1 mm., of the others about three and a-half are contained in the same space.

In tangential sections the large or proper cells (excluding those which exceed the average dimensions) are very uniform in size and shape, and are in contact only at limited points of their circumference, this limitation being dependent upon the size, number and distribution of the interstitial cells. The spaces between the larger cells (including those above the [illegible]) are occupied by triangular, sometimes sub-rhomboidal, interstitial cells, which are very regularly distributed.

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* This sentence reads in the original "no spiniform tubuli." The writer called Mr. Ulrich's attention to this inadvertence, and he has supplied the words now inserted.

In longitudinal sections the larger tubes are seen to be crossed by a few horizontal [illegible] slightly curved, and frequently very oblique diaphragms, which become more numerous near the surface of the corallum. In the smaller tubes the diaphragms are straight, horizontal and very close set. [illegible] spiniform tubuli are present at the [illegible] giving rise to a slight inflation [illegible]

[illegible] *Diplotrypa Milleri.* [illegible] but it differs therefrom [illegible] the diaphragms of the smaller [illegible] than those of the large ones. [illegible]

[illegible] Trenton Formation.

[illegible]

[illegible] Nicholson.

[illegible]

[illegible] Trenton formation [illegible]

[illegible]

[illegible] surface smooth, [illegible] than the average. [illegible]

Peterboro', Ontario," and "common (the 'puff-ball variety') in the Hudson River group of Toronto, Weston, and other localities in Ontario." It has now to be recorded from the Chazy Formation of the Island of Montreal, an individual in the Museum of the Geological and Natural History Survey, having been identified with this species.

Collector.—E. Billings.

MONOTRYPELLA, Ulrich.

"Ramose, smooth or tuberculated. Cells apparently of one kind only. Walls very thin in the axial portion of the branches, but much thicker in the peripheral region. Diaphragms straight. No spiniform tubuli. Trenton and Cincinnati." (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 153, 1882.)

MONOTRYPELLA TRENTONENSIS, Nicholson, Sp.

Monticulipora (Heterotrypa) Trentonensis, Nicholson. "The genus Monticulipora," p. 149, fig. 28, 1881.

Locality and Formation.—Dr. Nicholson records this species as "abundant in the Trenton Limestone of Peterboro', Ontario." It covers large surfaces of the strata in the Trenton Formation in and around Ottawa City, and is common throughout this formation in Canada. It is difficult to distinguish this species from *Homotrypa similis*, Foord, by its external characters alone, and microscopic sections are necessary in order to separate the two species with certainty. The specimen figured by Billings in the "Geology of Canada" (p. 156, fig. 116, 1863), as *Stenopora fibrosa*, Goldfuss, should probably be referred to *Monotrypella Trentonensis.*

Collectors.—Sir W. E. Logan, W. R. Billings, H. M. Ami, A. H. Foord.

MONOTRYPELLA ÆQUALIS, Ulrich.

Monotrypella æqualis, Ulrich, Journ. Cincinnati Soc. Nat. Hist., p. 247, plate II., figs. 3, 3*a*, 3*b*, 1882.

Locality and Formation.—Not uncommon in the Black River Formation at Paquette's Rapids, on the Ottawa River.

Collector.—J. Richardson.

AMPLEXOPORA, Ulrich.

"Ramose, free or incrusting. Cellular structure as in *Monotrypella*, excepting that more or less numerous spiniform tubuli are developed, which sometimes completely encircle the tubes. Cincinnati to sub-carboniferous." (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 154, 1882.)

AMPLEXOPORA SUPERBA. (N. Sp.)

Plate IV., figs. 1-1c.

Zoarium irregularly ramose, very robust in its habit of growth; branches cylindrical, measuring from 10 to 12 mm. in their greatest diameter, the longest measured gives about 20 centimetres as its greatest length. Surface of the branches studded with slightly raised monticules, which consist of cells rather larger than the average. Cell-apertures sub-polygonal in outline, about three occupying the space of one mm., except upon the monticules, where two or two and a-half suffice to fill the same space.

In tangential sections the cells appear to be somewhat rounded at their angles, the original walls, which are quite distinct, being considerably thickened near the surface of the zoarium by a secondary deposit of sclerenchyma. Large and conspicuous spiniform tubuli are distributed at the angles of junction of the cell walls, and occasionally one is situated on the line between two of these angles, and when this occurs a slight inward protrusion of the cell wall is the result.

Longitudinal sections show the tubes to be thin-walled in the axial region of the zoarium, and to be somewhat sparingly supplied with straight, horizontal diaphragms; these become much more numerous, and sometimes coalescent, near the periphery, where also the walls of the tubes are much thickened. The tubes bend gradually upwards and outwards as they approach the surface.

The present species may be distinguished from *Amplexopora robusta*, Ulrich, to which it is closely allied, by the possession of monticules, by its more conspicuous spiniform tubuli, as seen in tangential sections, and by the absence of the funnel-shaped diaphragms occurring in that species.

Locality and Formation.—This beautiful species appears to be rare. Montreal, Que., Trenton Formation.

Collector.—Sir W. E. Logan.

AMPLEXOPORA CANADENSIS. (N. Sp.)

Plate IV., figs. 2-2*d*.

Zoarium ramose, consisting of stout, sub-cylindrical, somewhat compressed branches, measuring from 20 to 25 mm. in their greatest diameter. Surface smooth and quite destitute of monticules. Cell-apertures polygonal, nearly equal in size, about three and a half occupying the width of 1 mm.

In tangential sections the cell-walls are seen to be moderately thick, and to be provided at their angles of junction with spiniform tubuli of medium size.

Longitudinal sections show that the tubes have moderately thin walls in the axial region, and that they are provided with very numerous horizontal, slightly curved diaphragms, three or four of which occupy a space equal to a tube diameter; these diaphragms sometimes coalesce. Towards the periphery the proper wall of the tubes is considerably thickened by an investment of light coloured sclerenchyma of fibrous texture.

This species may be separated from *Amplexopora superba*, Foord, which is its nearest ally, by the absence of monticules, and by its very abundant horizontal diaphragms.

Locality and Formation.—St. Joseph Island, Lake Huron, Black River Formation ; Joliette, Que. Trenton Formation.

Collectors.—T. C. Weston, H. M. Ami.

AMPLEXOPORA DISCOIDEA, Nicholson, Sp.

Monticulipora (*Monotrypa*) *discoidea*, James. "The genus Monticulipora," p. 193, Plate IV., figs. 3,-3*f*, 1881.

Locality and Formation.—Ottawa City. Trenton Formation.

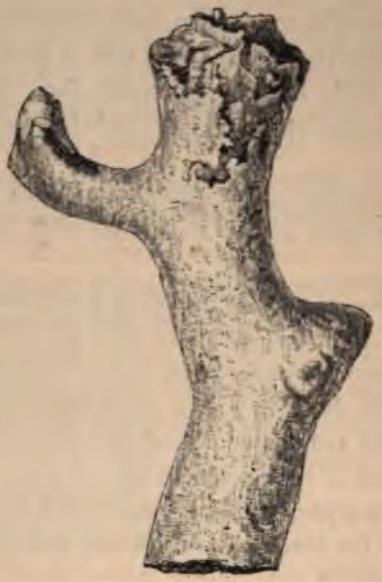
Collector.—Walter R. Billings.

BATOSTOMA, Ulrich.

"Irregularly ramose, with a large basal expansion, by means of which the zoarium is attached to foreign bodies. Cell-apertures in the outer portion of the branches irregularly ovate or circular, and surrounded by a distinct ring-like wall. Interstitial tubes more or less numerous, very irregular in shape and size. Spiniform tubuli numerous and well developed." Black River, Trenton and Cincinnati. (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist.. Vol. V., p. 154, 1882.)

BATOSTOMA OTTAWAENSE. (N. Sp.)

Plate II., figs. 1-1*f*.



Batostoma Ottawaense. (N. Sp.) A silicified fragment of the ramose zoarium of this species, from the Black River Formation of Paquette's Rapids on the Ottawa River. Natural size.

Zoarium ramose to frondescent. The ramose forms consist of stout, cylindrical or sub-cylindrical, dichotomous branches, varying in thickness from 10 to 16 mm. The frondescent forms are palmate with compressed branches measuring from 10 to 18 mm. in breadth at their bases and tapering towards their extremities to an obtuse point. Greatest breadth of the frond 4 cent.; thickness about 6 mm. Surface of both forms covered with small and inconspicuous monticules placed at variable distances apart and occupied by from ten to fifteen cells slightly larger than the average. Cell-apertures very variable in outline, usually sub-circular, especially on weathered surfaces. They average about ·5 mm. in diameter.

Tangential sections show that in the axial portion of the zoarium the larger tubes are angular, polygonal, thin-walled and very variable in size and shape. As they approach the surface they become greatly thickened by a secondary deposit of sclerenchyma of fibrous structure. The cells in this region consequently lose their angularity, and become rounded or semi-oval, sometimes narrow and bean-shaped. In some places the walls throw out slender prolongations or blunt spines, these are the incomplete diaphragms to be described further on. (See plate II., fig. 1*b*.) The interstitial tubes fill up the spaces between the larger ones and are best seen in sections, ground a little below the surface of the zoarium where they have not become obliterated, as in the peripheral region, by the secondary deposit of sclerenchyma. In the axial region they are not met with at all, as they do not extend far below the surface. Large spiniform tubuli occur at the angles of junction between the larger tubes or in the substance of their walls; the sections of these tubuli are strongly defined by a dark ring with a white spot in the centre, making them very conspicuous objects in a tangential section. Excepting in places where the tubes have been cut a little deeper, their original walls are barely distinguishable in the dense secondary deposit of sclerenchyma; but they may be detected here and there as somewhat obscure lines connecting the spiniform tubuli together.

Longitudinal sections exhibit numerous diaphragms, some of which are complete, but the greater number do not extend more than half way across the tubes; in some places they appear merely as obtuse spinous projections of the walls of the tubes. The diaphragms are generally straight, sometimes slightly curved, and often rather oblique to the axis of the tubes. Many of the incomplete diaphragms are thickened at their distal extremity into a little knob. Like the walls of the tubes, the diaphragms in the axial region of the zoarium are very slender and only become thickened as they approach the periphery. They are about half a tube diameter apart.

This species may be readily separated from its nearest ally—*Batostoma Jamesi*, Nicholson, Sp. (the type of the genus)—by its numerous transverse diaphragms and their peculiar incomplete development in many of the cells.

Locality and Formation.—This species is not uncommon in the upper beds of the Trenton Formation in the vicinity of the City of Ottawa. It has also been found at Paquette's Rapids (Ottawa River) in the Black River Formation.

Collectors.—Walter R. Billings, Ottawa City; J. Richardson, Paquette's Rapids.

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HETEROTRYPA, Nicholson, (Restricted.)

"Zoarium frondescent, rarely incrusting. Tubes prismatic. Interstitial cells developed in moderate numbers, sometimes collected into 'maculæ.' Spiniform tubuli small, more or less numerous. No cystoid diaphragms." Trenton and Cincinnati. (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 155, 1882.)

Since the above was written Mr. Ulrich has published a more detailed description of the genus, which is here subjoined:—

"Zoarium growing from an expanded base, attached to foreign objects, upward into simple, often undulated or irregularly inosculated fronds, and occasionally into flattened branches. Cell-apertures varying in shape from polygonal to circular. They are separated from each other by walls or interspaces, which may be comparatively thin (*H. solitaria*, Ulrich), or nearly as thick as their own diameter (*H. Vaupeli*, Ulrich). Interstitial cells from few to very numerous, always angular or sub-angular. Spiniform tubuli small, usually numerous (sometimes excessively so, as in H. Vaupeli), occasionally inflecting the walls, and giving the cell-apertures an irregularly petaloid appearance. Internally we find that the walls of the tubes are more or less thickened as they enter the 'mature' region, and apparently amalgamated with one another. The diaphragms are [illegible], more numerous in the interstitial tubes than in the [illegible], and always more crowded in the 'mature' regions than in the 'immature' or axial regions." (E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. VI., p. [illegible], 1883.)

[illegible] SOLITARIA, Ulrich.

[illegible]

[illegible]

[illegible]

[illegible] Baxter & Billings.

[illegible]

[illegible]

SPATIOPORA AREOLATA. (N. Sp.)

Plate V., figs. 1,-1*i*.

Zoarium parasitic (?) forming very thin, circular, flattened expansions, from which proceed projecting cylindrical processes, which become thickened gradually from their centre towards the proximal and distal extremities. The zoarium varies in size from one to two centimetres in diameter, and from ·75 to 1 mm. in thickness. The longest of the projecting processes attains a length of one centimetre, and varies in thickness from 1 to 2·5 mm. The upper surface of the zoarium is covered with low, somewhat inconspicuous monticules, upon which the cells appear to be smaller than they are on the general surface of the zoarium. The under surface, which is the one most frequently met with, is marked by very conspicuous, hexagonal, shallowly concave areas, giving to this aspect of the fossil very much the appearance of *Comarocystites punctatus*, Billings, for weathered examples of which it has often been mistaken. The projecting processes appear to originate from the margin of the zoarium, at short intervals, though there are obscure indications of their attachment to other parts of the disc. The cells, which are seen on both surfaces of the zoarium, are of two kinds; of the larger ones there are about three in the space of 1 mm.

Tangential sections show that the cells of both kinds are thin-walled; that the larger ones are polygonal in outline, and that the small interstitial cells fill up the spaces between them. Spiniform tubuli are developed at the angles of junction of the cell-walls.

Longitudinal sections exhibit rather remote, straight diaphragms in the larger tubes, and these are much more numerous and close set in the smaller ones.

Mr. Ulrich, of Cincinnati, has suggested to the writer that the concave areas of the under surface of this species may be accounted for by supposing that it "grew parasitically upon a foreign body, marked with polygonal convex spaces, which, during the process of fossilization, was destroyed." He adds in another place: "as the markings of a *Pasceolus* (e. g. *P. globosus*, Billings), would just fit the impressions [in the *Spatiopora*,] I naturally came to the conclusion that the zoarium was attached to such an object." Mr. Ulrich further remarks: "In our rocks [those of the Cincinnati group, at Cincinnati], there are several species, which having decayed, are as yet known only by their impressions in parasitic bryozoa, and in most cases where parasitic bryozoa are found in our rocks the supporting object has decayed, and left a clear and distinct impression of even its most fine markings in the membranaceous epitheca of the zoarium." There is one circumstance which makes the writer hesitate to concur in Mr. Ulrich's opinion that *Spatiopora areolata* was parasitic upon a *Pasceolus*, and that is the fact that the former has been found only in the *lower* beds of the Trenton formation, in which *Pasceolus* does not occur; the latter is found only in the *upper* shaly beds of the Trenton, about 180 feet above the lower ones, and near the horizon of the Utica Formation.

Locality and Formation.—Hull, Que., in the lower beds of the Trenton Formation.

Collectors.—Walter R. Billings, H. M. Ami, A. H. Foord.

STELLIPORA ANTHELOIDEA, Hall.

Stellipora antheloidea, Hall, Pal., N.Y., Vol. I., p. 79, pl. XXVI., figs. 10*a*, 10*b*, 1847.
Stellipora antheloidea, D'Orbigny, Prodr. de Paléont, t. 1, p. 22, 1850.
Constellaria antheloidea, Edwards and Haime, Pol. Foss. des Terr. Pal., p. 279, pl. XX., figs. 7-7*b*, 1851.
Constellaria antheloidea, Nicholson, Pal. of Ohio, Vol. II., p. 214, 1875.
Constellaria antheloidea, Nicholson, Ann. Nat. Hist., ser. 4, Vol. XVIII., p. 92, pl. V., fig. 10, 1876.

Locality and Formation.—Ottawa City. Trenton Formation. Two fragments of this species, imperfectly preserved, have been identified.

Collector.—Walter R. Billings.

CONSTELLARIA FLORIDA, VAR. PLANA, Ulrich, MS.

This species has been identified by Mr. Ulrich.

Locality and Formation.—Ottawa City. Trenton Formation.

Collector.—E. Billings.

II. *On some previously unrecorded Species of Ptilodictya, Stictopora, and Arthronema, from the Trenton Formation.*

PTILODICTYA PAVONIA, D'Orbigny.

Ptilodictya pavonia, D'Orbigny, Prodr. de Paléont, Vol. 1, p. 22, 1850.
Chætetes pavonia, Milne-Edwards and Haime, Pol. Foss. des Terr. Pal., p. 267, pl. XIX., figs. 4, 4*a*, 1851.
Chætetes pavonia, Rominger, Proc. Acad. Nat. Sci. Phil., 1866, p. 116.
Stictopora clathratula, James, Cat. Foss. Cincinnati Group, 1871.

Chætetes? clathratulus, Nicholson, Quart. Journ. Geol. Soc., Vol. XXX., p. 509, pl. XXX., figs. 1-1*b*, 1874. Pal. Ohio, Vol. II., p. 209, pl. XXII., figs. 2-2b, 1875. Ann. Nat. Hist., ser. 4, Vol. XVIII., p. 91, pl. V., figs. 9, 9a, 1876.

Heterodictya pavonia, Ulrich, Cat. Foss. Cincinnati Group, p. 10, 1880.

Ptilodictya pavonia, Ulrich, Journ. Cincinnati Soc. Nat. Hist., p. 163, 1882.

A single example of this beautiful form has been collected, the first found in Canada. It consists of a fragment of the frond measuring about 6 centimetres in length, about 3·5 centimetres in its greatest breadth, and from 3 to 5 mm. in thickness.

Locality and Formation.—Ottawa City. Trenton Formation.

Collector.—Walter R. Billings.

PTILODICTYA MACULATA, Ulrich.

Ptilodictya maculata, Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 163, Plate VI., fig. 17, and Plate VII., figs. 4, 4*a*, 1882.

This species appears to be not uncommon in the lower beds of the Trenton Formation near Ottawa City. The largest specimen in the Survey collection measures about 9 centimetres in length, and about 2·5 centimetres in its greatest breadth.

This is doubtless the species referred to by Dr. Nicholson in his description of *Ptilodictya falciformis*, (Pal. Ontario, p. 13, 1875), where he says he has seen "examples of what may ultimately prove to be a distinct species, in which the width of the frond greatly exceeds" that of *P. falciformis*.

Locality and Formation.—Hull, Que., in the lower beds of the Trenton Formation.

Collectors.—Walter R. Billings, H. M. Ami.

STICTOPORA PAUPERA, Ulrich, MS.

Mr. Ulrich has identified this species, which is associated with *Spatiopora areolata*, Foord.

Locality and Formation.—Hull, Que., in the upper beds of the Trenton Formation (also in the upper Trenton Group of Burgin, Kentucky).

Collector.—W. R. Billings.

ARTHRONEMA TENUE, James, Sp.

Helopora tenuis, James, "The Palæontologist," Cincinnati, Ohio, No. 1, p. 3, July, 1878.

Arthronema tenue, James, Sp., E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist., Vol. V., p. 160, Plate VI., figs. 8,-8*c*, 1882.

Locality and Formation.—Not rare in the Trenton Formation, near Montreal City.

Collectors.—T. C. Weston, T. Curry.

III. *On Two Species of Tetradium from the Trenton and Hudson River Formations.*

TETRADIUM PEACHII, Nich. and Eth., jun., Var. CANADENSE. (N. Var.)

Plate VI., figs. 1,-1*i*.

In the Trenton formation there occur very abundantly certain small, rounded masses, the organic nature of which had for a long time been doubted. A microscopic examination of these masses has proved them to be a variety of a species found in pebbles of Upper Silurian Age from the Devonian (Old Red) conglomerate of Habbies Howe, in the Pentland Hills, Scotland, named by Dr. Nicholson and Mr. R. Etheridge, jun., *Tetradium Peachii.** The species is thus characterized by the authors :—

"Corallum massive, exceedingly dense and compact, composed of excessively minute, closely approximated corallites, about a thirty-fifth of a line in diameter. The corallites have an undulating course, and are sometimes disposed in superimposed layers, or arranged concentricaly round minor centres. Corallites thick-walled, irregularly circular or oval in transverse section, with a few (three or four ?) short septa, which are often thickened at their bases. Tabulæ numerous and complete. Corallum perforated by irregular tubes (water canals ?) from a fortieth to a fiftieth of an inch in diameter or less."

The variety occurs in the form of very compact, irregularly rounded, sub-globose masses, varying greatly in size, the smallest measured giving 12 mm. in its greatest diameter and the largest from 5 to 6 centimetres.

It is difficult to detect any trace of structure, even with a hand-lens, on the surface of weathered specimens, but polished surfaces exhibit a series of concentric lines, arranged symmetrically around several centres.

Through the courtesy of Dr. Nicholson and Mr. R. Etheridge, jun., the author was furnished with a specimen of *Tetradium Peachii*, from the typical locality, and this has been compared with the Canadian form. In its microscopic character the variety is essentially similar to the species, and differs from the latter only in having thicker and more wavy tube-walls, which are in somewhat closer proximity. No tabulæ have been seen in any of the Canadian specimens. As to their occurrence in the Scotch species Mr. R. Etheridge, jun., in a letter lately received by the author writes:—"With regard to the presence of tabulæ I must confess myself in doubt. Some specimens undoubtedly do not possess them, a fact which has already been commented on by Dr. Nicholson and myself, (Girvan Report, facic. 1, p. 32), but again in some sections I have seen horizontal divisions of the tubes, which I could refer to nothing else."

---

* Ann. Nat, Hist., Ser. 4, Vol. XX. p. 166, figs. *d*, *e*, *f*, *g*, 1877.

Taking into consideration the excessive minuteness of the corallites, and the sinuosity of their walls in *Tetradium Peachii*, and its variety *Canadensis*, and the doubtful existence of tabulæ in both, it would seem necessary to remove these forms from the genus *Tetradium*. The propriety of this course has perhaps occurred to the authors of the species.

Locality and Formation.—Abundant throughout the Trenton formation of the Province of Quebec, at the following localities: Hull, Joliette, Montmorency and Murray Bay.

Collectors.—Principal Dawson, T. C. Weston, H. M. Ami, A. H. Foord.

TETRADIUM HURONENSE, Billings, Sp.

Plate VII., figs. 1,-1c.

Stenopora Huronensis, Billings, Pal. Foss., Vol. I., p. 185, 1861–1865.

A microscopical examination having been made to ascertain the affinities of the *Stenopora Huronensis*, of Billings, it was found to belong to the genus *Tetradium*. The following is the amended description:—

Corallum very large, massive, rounded, growing in thin concentric laminæ, of about 1 to 2 mm. in thickness. Some specimens attain a diameter of about 30 centimetres, and an average thickness of about 7 centimetres. Corallites extremely long, from 6 to 12 centimetres in length. The surface is covered with prominent, rounded, or conical elevations, and these are seen on weathered, or polished sections to have covered the surface of each successive lamina of which the corallum was built up; this lamination gives to the fossil somewhat the appearance of a Stromatopora, as observed by Mr. Billings. The elevations are from four to six centimetres apart, measured from their summits; in height they are about 3 mm. The entire surface of the corallum, including the conical elevations, is covered with close-set, rounded granules, of which about three fill the space of 1 mm.; they diverge from the summit of the elevations in a stellate manner.

Corallites slender, usually irregularly four sided, closely approximated, tortuous; having a diameter of ·5 to ·75 of a mm. The cell-apertures exhibit three or four short septa, usually the latter number. Tabulæ numerous and complete, about four or five in the space of 1 mm. Walls thick. No epitheca has been observed.

This species of *Tetradium* is distinguished from all others by its large size, very characteristic surface ornamentation, and laminated mode of growth.

Locality and Formation.—Cape Smyth, Lake Huron. Hudson River Formation.

Collector.—Dr. R. Bell.

PLATE I.

Monticulipora Westoni. (page 7.)

Figure 1.	Tangential section, enlarged about thirty times.
“ 1 *a*.	Part of the same section, enlarged about ninety times.
“ 1 *b*.	Longitudinal section, enlarged about thirty times.

Monticulipora Billingsi. (page 8.)

Figure 2.	Zoarium of this species incrusting a small cylindrical body, probably part of a crinoid stem. Natural size.
“ 2 *a*.	Tangential section, enlarged about thirty times.
“ 2 *b*.	Part of the same section, enlarged about ninety times.
“ 2 *c*.	Longitudinal section, enlarged about thirty times.

Diplotrypa regularis. (page 13)

Figure 3.	Fragment of the zoarium. Natural size.
“ 3 *a*.	Tangential section, enlarged about fifteen times.
“ 3 *b*.	Part of the preceding section, enlarged about ninety times.
“ 3 *c*.	Longitudinal section, enlarged about thirty times.

GEOLOGICAL SURVEY OF CANADA. PLATE

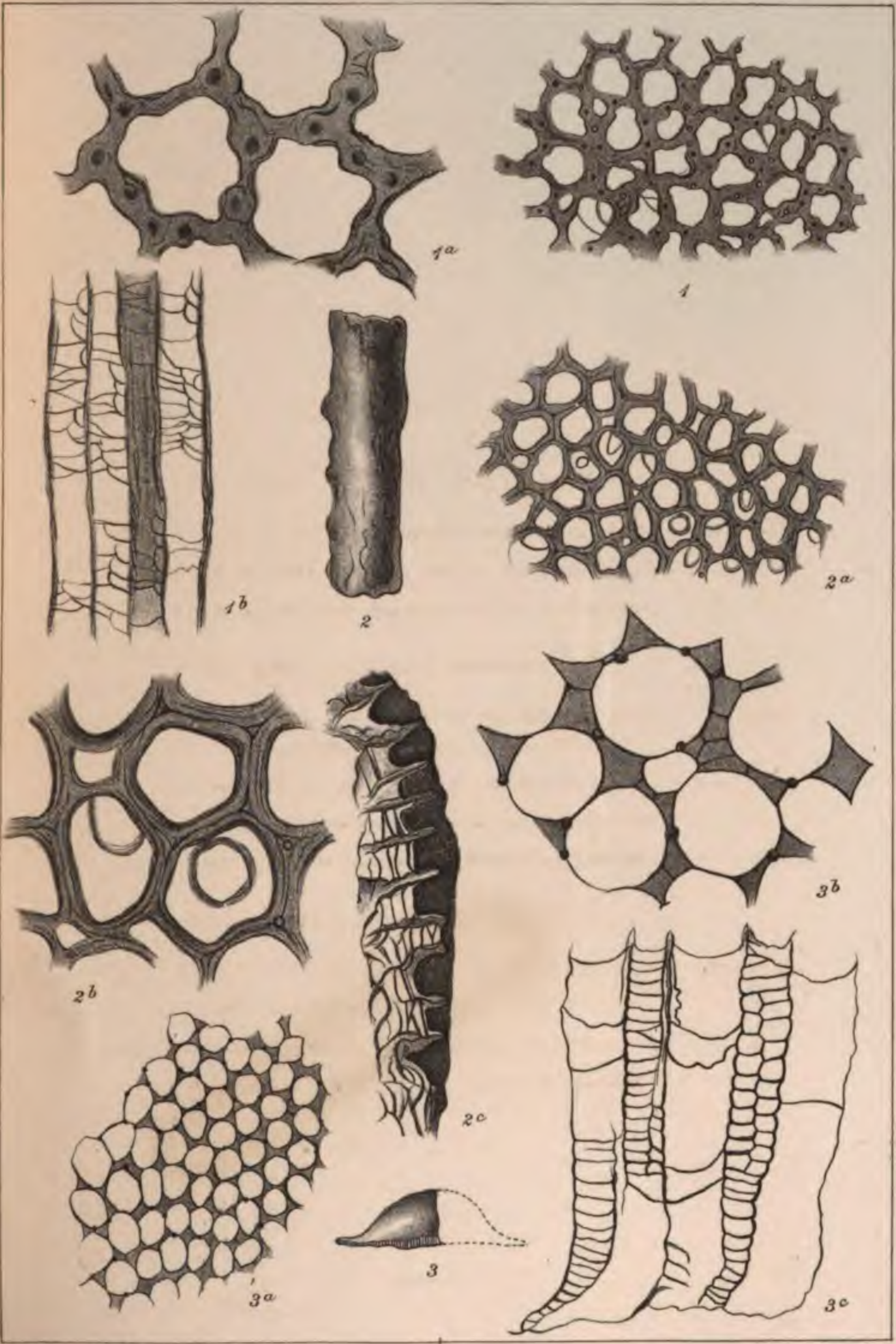

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PLATE II.

BATOSTOMA OTTAWAENSE. (page 18.)

Figure 1.	Portion of the frondescent form of the zoarium. Natural size.
" 1 *a*.	Fragment of the ramose form of the same. (See also wood cut, page .) Natural size.
" 1 *b*.	Tangential section from a specimen not figured. Enlarged about fifteen times.
" 1 *c*.	Tangential section, from the frondescent form (Fig. 1), showing the interstitial tubes. Enlarged about fifteen times.
" 1 *d*.	Portion of 1 *b* enlarged about thirty times.
" 1 *e*.	Longitudinal section showing the peculiar tabulation of this species. Enlarged about fifteen times.
" 1 *f*.	Portion of the preceding section, enlarged about thirty times.

HOMOTRYPA SIMILIS. (page 10.)

Figure 2.	Sub-cylindrical form of the zoarium of this species; 2 *a*. Compressed form of the same. Both natural size.
" 2 *b*.	Tangential section, enlarged about fifteen times.
" 2 *c*.	Portion of the same section, enlarged about ninety times.
" 2 *d*.	Longitudinal section, enlarged about fifteen times.

PLATE II

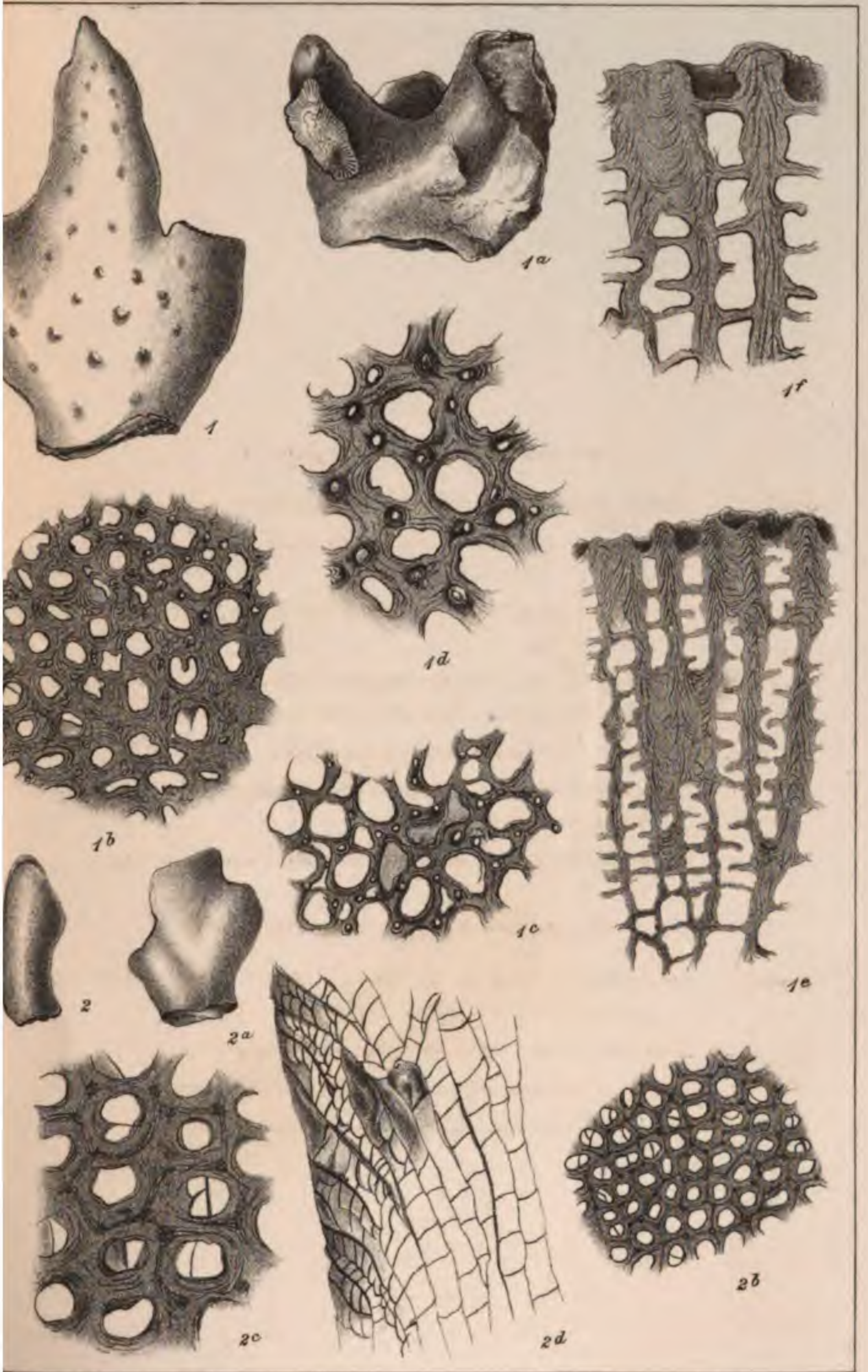

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PLATE III.

PRASOPORA OCULATA. (Page. 11)

Figure 1.	Fragment of the zoarium showing the characteristic surface ornamentation. Natural size.
" 1 *a.*	Side view of the same, showing the thickness of the zoarium.
" 1 *b.*	Under surface of a young individual, attached to a dorsal valve of *Orthis testudinaria,* shewing the wrinkled epitheca. Natural size.
" 1 *c.*	Upper surface of the same.
" 1 *d.*	Side view of the same.
" 1 *e.*	Tangential section showing the two sets of tubes with a cluster of the smaller ones. Enlarged about fifteen times.
" 1 *f.*	Portion of the same section enlarged about ninety times.
" 1 *g.*	Longitudinal section, enlarged about thirty times.

PRASOPORA AFFINIS. (Page 12.)

Figure 2.	Fragment of the zoarium. Natural size.
" 2 *a.*	Side view of the same.
" 2 *b.*	Tangential section, enlarged about thirty times.
" 2 *c.*	Longitudinal section showing the whole thickness of the zoarium. Enlarged about thirty times.

PLATE III

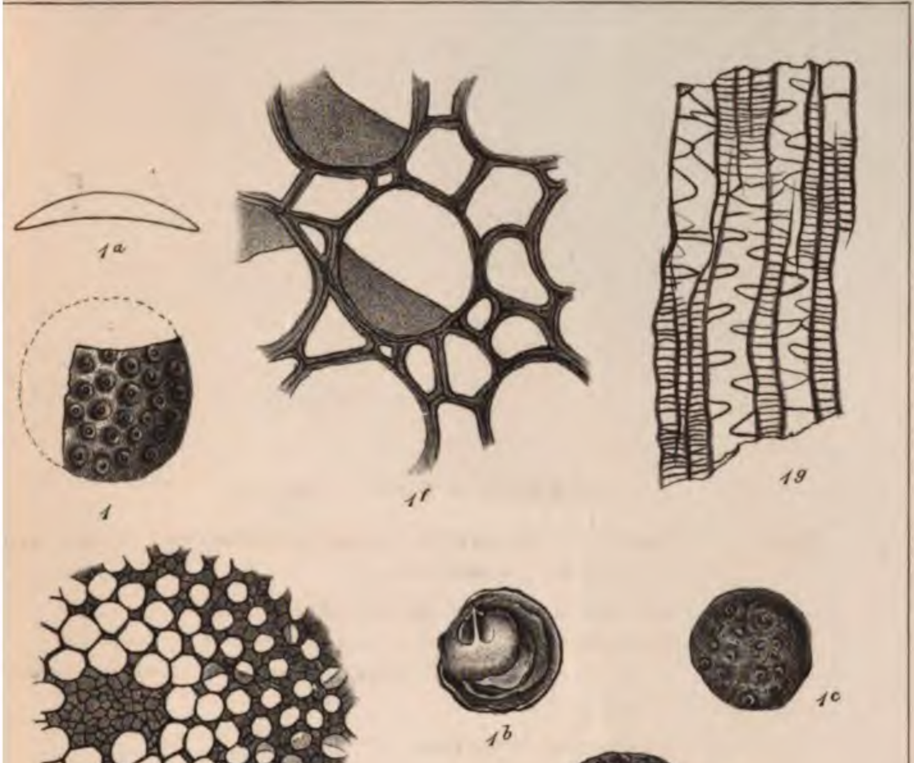

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PLATE IV.

Amplexopora superba. (Page 16.)

Figure 1.	Fragment of the zoarium. Natural size.
" 1 *a.*	Tangential section, enlarged about fifteen times.
" 1 *b.*	Portion of the same, enlarged about thirty times.
" 1 *c.*	Longitudinal section, enlarged about fifteen times.

Amplexopora Canadensis. (Page 17.)

Figure 2.	Fragment of the zoarium. Natural size.
" 2 *a.*	Tangential section, enlarged about fifteen times.
" 2 *b.*	Portion of the same, enlarged about thirty times.
" 2 *c.*	Portion of a tangential section from another specimen, similarly enlarged to show more clearly the spiniform tubuli.
" 2 *d.*	Longitudinal section, enlarged about fifteen times.

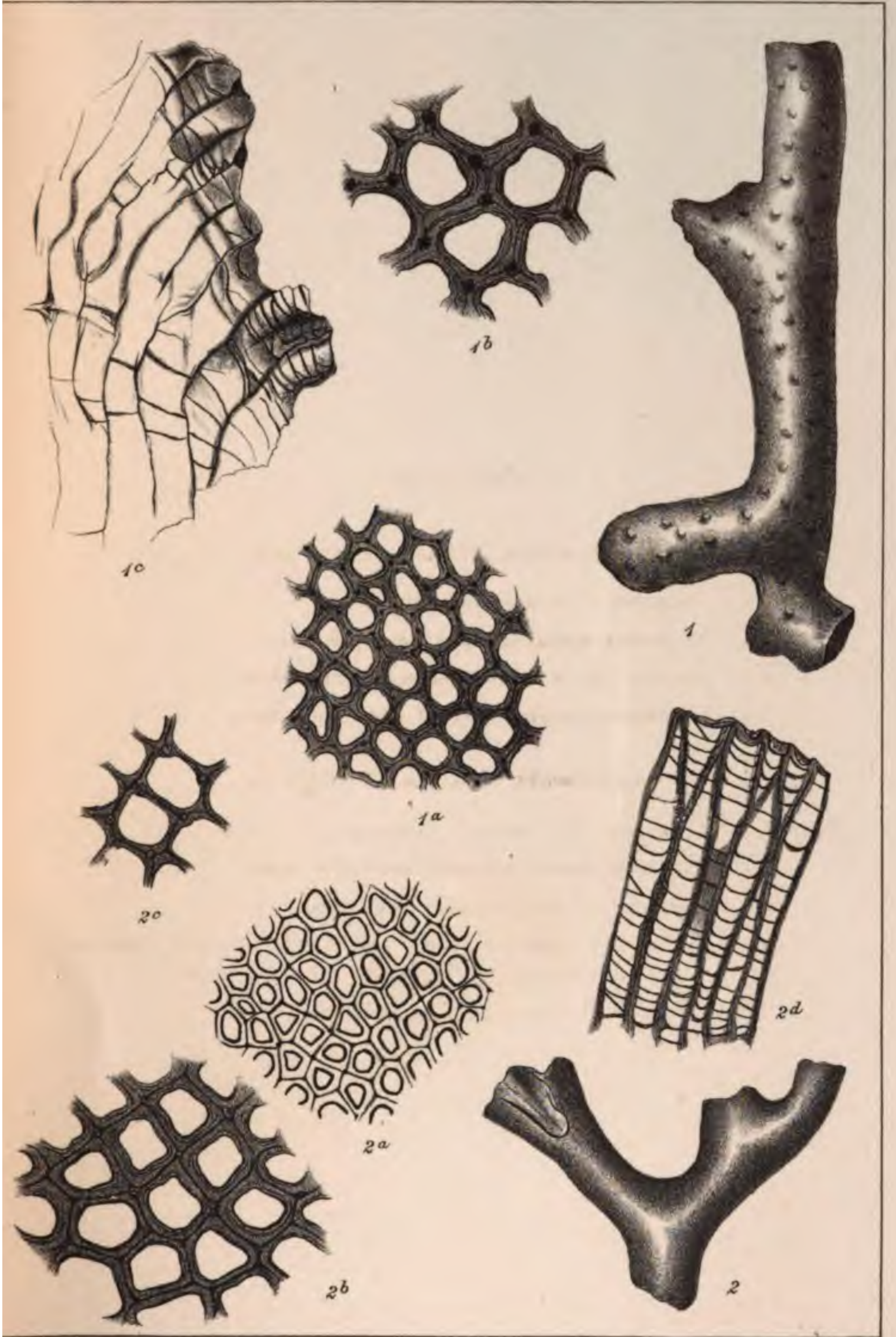

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PLATE V.

Spatiopora areolata. (page 21.)

Figure 1. Fragment of the upper surface of the zoarium, showing monticules, and one of the projecting processes at the margin. Natural size.

" 1 *a*. Fragment of the under surface showing the hexagonal concave areas. Natural size.

" 1 *b*. Another fragment of the under surface showing three of the projecting processes. Natural size.

" 1 *c*. Tangential section showing a few spiniform tubuli. Enlarged about thirty times.

" 1 *d*. Tangential section of a single cell, enlarged about ninety times.

" 1 *e*. Portion of a transverse section cut as far below the surface as the extreme tenuity of the zoarium would admit; showing spiniform tubuli. Enlarged about thirty times.

" 1 *f*. Part of a longitudinal section, showing the larger tubes with very few diaphragms, and two or three of the interstitial tubes in which the diaphragms are more numerous. Enlarged about thirty times.

" 1 *g*. Longitudinal section showing the under surface with one of the concave areas, and the upper surface buried in the matrix. Enlarged about fifteen times.

" 1 *h*. Longitudinal section showing upper surface of the zoarium, the lower surface being embedded in the matrix. Enlarged about fifteen times.

" 1 *i*. Transverse section (the upper figure) and longitudinal section (the lower figure) of one of the projecting processes. Enlarged about thirty times.

GEOLOGICAL SURVEY OF CANADA. PLATE V

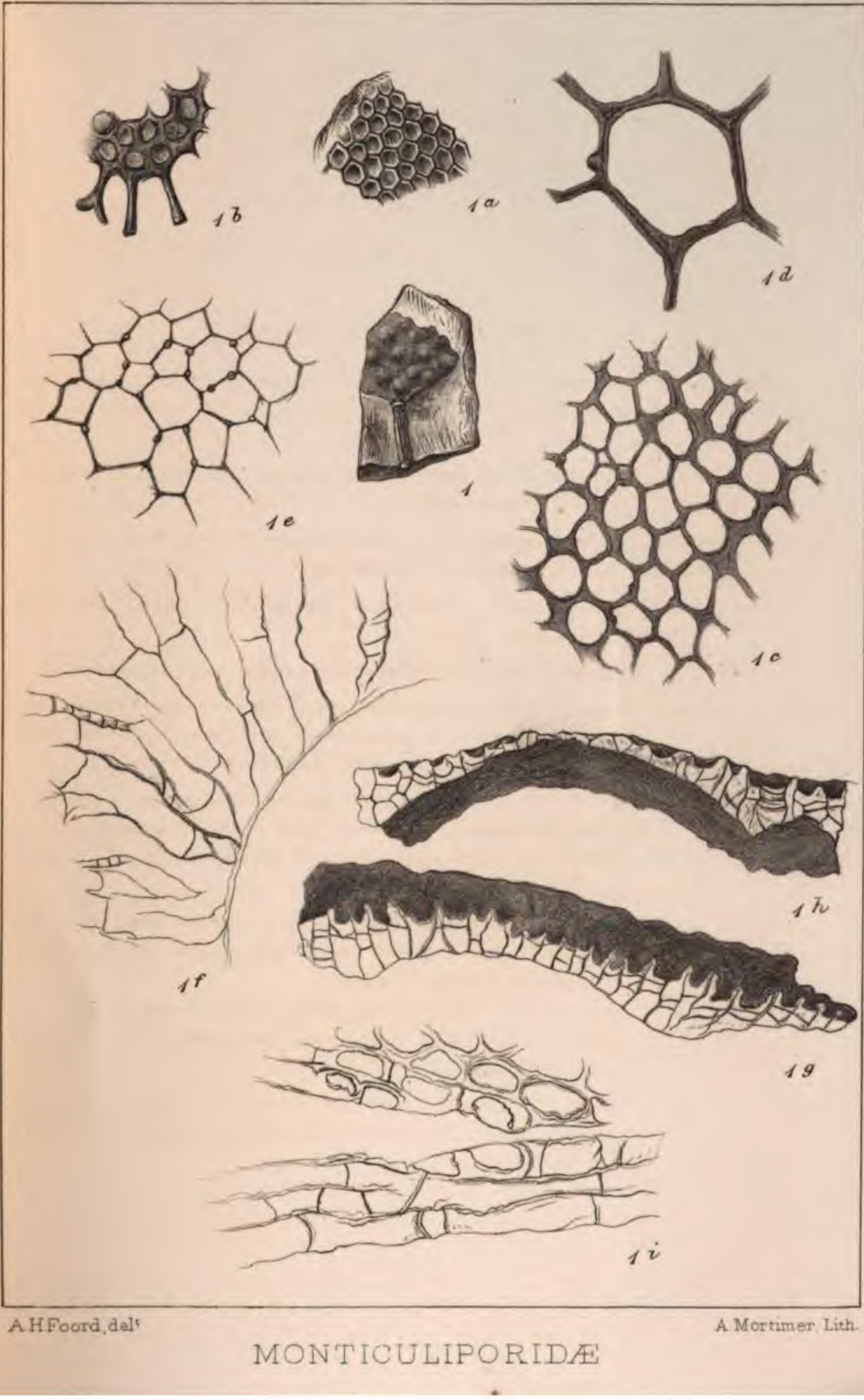

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PLATE VI.

TETRADIUM PEACHII, Nich. and Eth., jun., var. CANADENSE. (Page 24.)

Figure	1.	Fragment of a large specimen. Natural size.
"	1 *a.*	A smaller specimen. Natural size.
"	1 *b.*	Polished section of a small specimen, showing concentric lines. Natural size.
"	1 *c.*	Transverse section, enlarged about forty times.
"	1 *d.*	Part of the same enlarged about ninety times.
"	1 *e.*	Transverse section showing one of the water canals, (?) Enlarged about forty times.
"	1 *f.*	Longitudinal section, showing the wavy walls of the corallites, and the concentric lines, crossing these nearly at right angles.

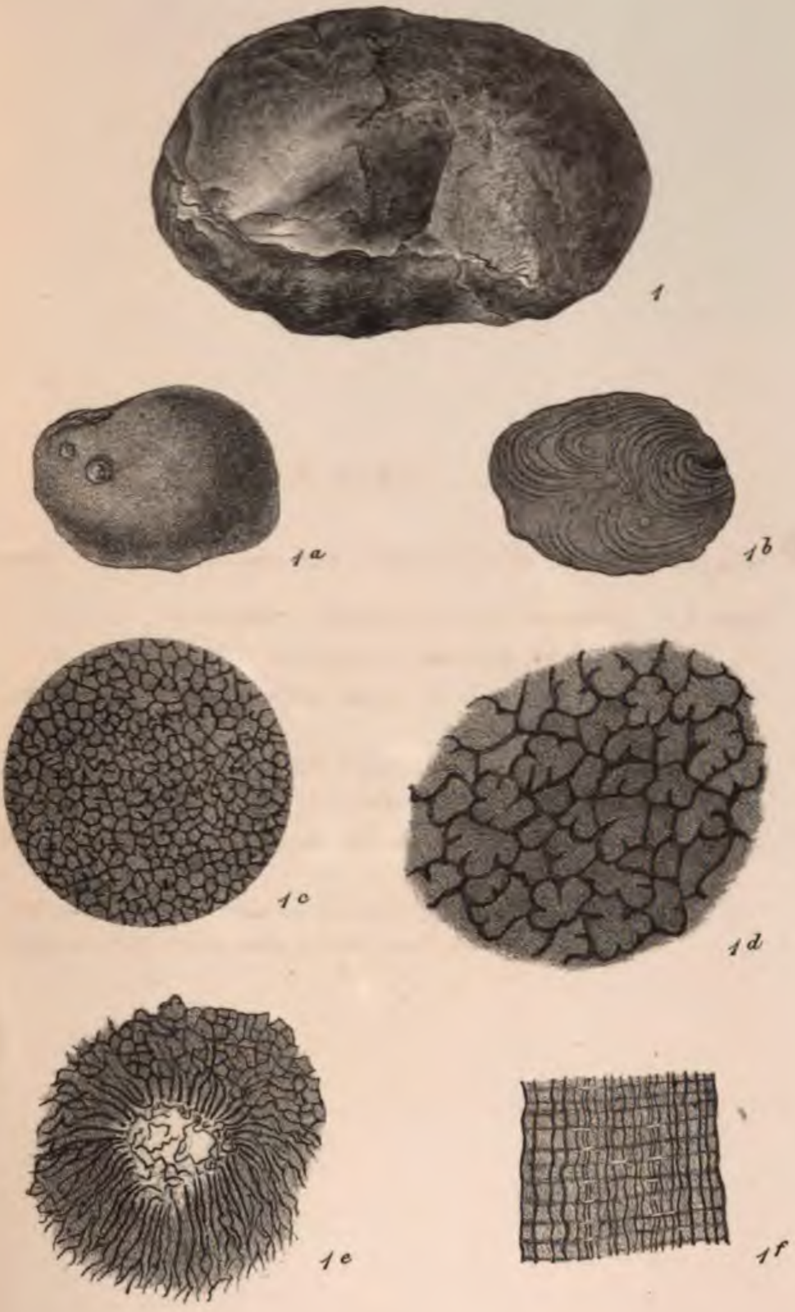

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PLATE VII.

TETRADIUM HURONENSE, Billings, Sp. (Page 25.)

Figure 1. Fragment of the corallum of this species. Natural size.

" 1 *a.* Part of a large weathered specimen, showing successive laminæ with some of the conical elevations upon them. Natural size.

" 1 *b.* Part of a tangential section showing three or four short septa in the cell-apertures. Enlarged about fifteen times.

" 1 *c.* Another part of the same section, similarly enlarged.

" 1 *d.* Longitudinal section, showing the tabulæ. Enlarged about fifteen times.

" 1 *e.* Longitudinal section showing on the upper edge the surface granules. Enlarged about fifteen times.*

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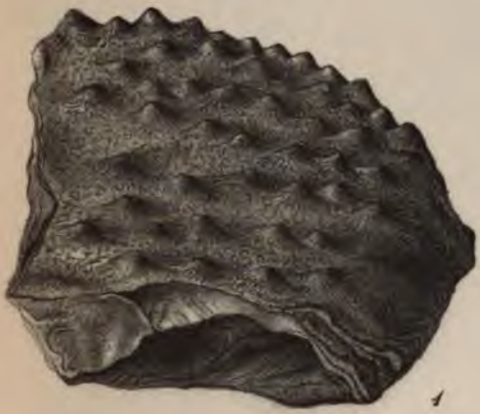
* Through an oversight this figure has been placed obliquely as regards the corallites; it should be in the same position as figure 1 *d.*



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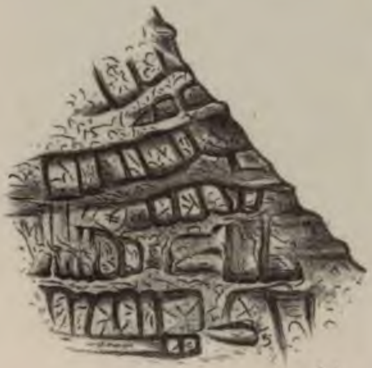

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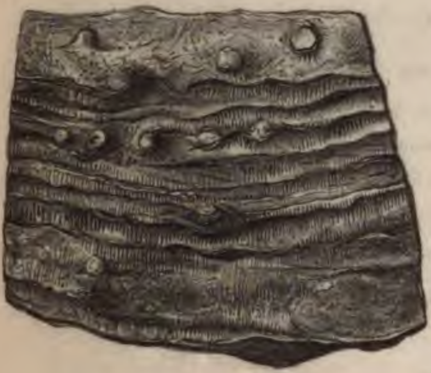

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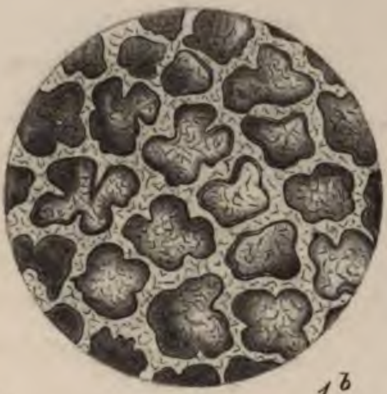

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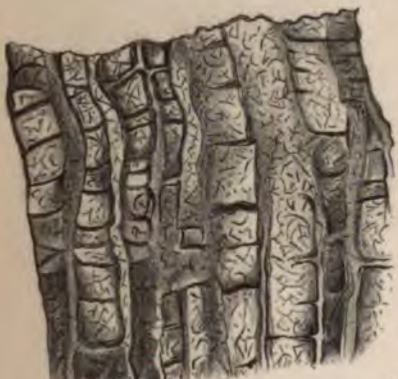

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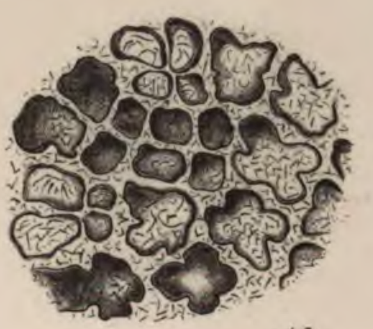

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OF THE

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PART II.

BY

E. O. ULRICH.

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NOTE.

The second part of the Contributions to the Micro-Palæontology of the Cambro-Silurian rocks of Canada herewith submitted, has been kindly prepared by Mr. E. O. Ulrich, of the Geological Survey of Illinois.

It consists of a descriptive report on some fossil Polyzoa (Bryozoa) and Ostracoda from Manitoba, and is illustrated by two full page lithographic plates.

To facilitate the binding of the present Part with Mr. Foord's previously published Report, the pagination and numbering of the plates of both have been made consecutive.

ALFRED R. C. SELWYN,
Director Geological and Natural History Survey.

OTTAWA, November, 1889.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

CONTRIBUTIONS TO THE MICRO-PALÆONTOLOGY OF THE CAMBRO-SILURIAN ROCKS OF CANADA.

PART 2.

By E. O. Ulrich.

4.—*On some Polyzoa (Bryozoa) and Ostracoda from the Cambro-Silurian rocks of Manitoba.*

INTRODUCTION.

The following report on some fossil Polyzoa[*] (Bryozoa) and Ostracoda from Manitoba is based upon a small collection of specimens which had been made at various times between the years 1875-84, both inclusive, by different members of the Survey, but mostly by Mr. T. C. Weston. This material, together with thirty-five microscopic sections of most of the species represented, prepared by Mr. Weston, which were an important aid to me in their study, was sent to me in February, 1887, for examination, by Mr. J. F. Whiteaves, the palæontologist to the Survey.[†]

The fossils were studied, the drawings made and the two plates printed in 1888, but, in consequence of adverse circumstances entirely beyond my control, the descriptions could not be written out until quite recently.

The terminology employed in describing the Polyzoa (Bryozoa) is the same as that adopted in my report on the Illinois Bryozoa, in the forthcoming volume (VIII.) of the Illinois Geological Survey Reports.

E. O. ULRICH.

Newport, Kentucky, April 3rd, 1889.

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[*] In conformity with long usage in the Survey Reports and with that of most British writers, the term Polyzoa (Thompson) is here adopted rather than Bryozoa (Ehrenberg) though Mr. Ulrich, in common with the majority of European and U.S. naturalists, prefers the latter.—J.F.W.

[†] The Ostracoda sent had not been critically examined in Ottawa, but among the Polyzoa three species, viz., *Bythopora delicatula*, *Monotrypella quadrata*, and *Phylloporina Trentonensis*, had been recognized, as well as *Solenopora compacta*, whose systematic position is still doubtful, though it is placed by Zittel among the Bryozoa).—J.F.W.

November, 1889.

DESCRIPTION OF SPECIES.

POLYZOA.

PROBOSCINA AULOPOROIDES, Nicholson.

Alecto auloporoides, Nicholson. 1875. Pal. Ohio, vol. 2, p. 267, pl. 25 figs. 2-2*b*.

The collection affords a small and rather badly preserved fragment of a species of *Proboscina* indistinguishable from Nicholson's *Alecto auloporoides*. The cells are mostly uniserial, or rather alternating biserial, without, however, having their sides exposed, the outer margins of the adnate zoarium forming a nearly straight line. The zoœcia, consequently, are to be regarded as "immersed," the same as in *P. frondosa*, Nicholson, sp., and the typical species of *Proboscina*. This immersion of the zoœcia is the character relied upon in separating the genus or sub-genus *Proboscina* from *Stomatopora*, the true species of the latter having the sides of their cells exposed and the margins of the zoarium conforming to their shape. Of Silurian species *S. Proutana*, S. A. Miller, *S. arachnoidea*, Hall, and *S. elongata*, Vine, are true species of *Stomatopora*.

Species of the nature of *P. auloporoides* and *P. frondosa* are, in my opinion, more nearly related to *Berenicea* than to *Stomatopora*[*]. In comparing numerous species, it becomes a matter of no small difficulty to determine where *Proboscina* should end and *Berenicea* begin. On the other hand, the non-immersed condition of the zoœcia and their strictly uniserial arrangement in *Stomatopora* furnishes us with two characters that, so far as my observation is concerned, enable us to distinguish readily enough between *Proboscina* and *Stomatopora*.

Stony Mountain, T. C. Weston, 1884. This species also is not uncommon in the middle beds of the Hudson River or Cincinnati group, at Cincinnati, Ohio, and other localities in the United States where these beds are exposed.

PROBOSCINA FRONDOSA, Nicholson.

Alecto frondosa, Nicholson. 1875. Pal. Ohio, vol. 2., p. 266, pl. 25, figs. 3-3*b*.

This form is likewise represented by but a single example. It is of the typical variety, and, though a little worn, preserves here and there the minute perforations in the walls of the zoœcia. The latter occur in from two to seven irregularly alternating ranges, and, where best preserved, are provided with strongly elevated apertures.

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[*] *Berenicea* of Lamoureux, Haime, Reuss and Zittel, not of Busk, Hincks and Vine, who, contrary to accepted rules of nomenclature, use *Diastopora* instead. Lamoureux originally proposed *Berenicea* for incrusting forms of the type of *B. diluviana*, while *Diastopora* was applied by him to the erect double-leaved forms typified by his *D. foliacea*.

A careful comparison between this species and *P. auloporoides* will most probably prove that the former is only a variety of the latter. I can see no difference between them except that in the number of ranges of the zoœcia. Though I have not given this group of bryozoa the study it demands, I have, nevertheless, examined enough material to learn that when the zoœcia form more than one range, their number is too variable to be accorded specific importance.

Stony Mountain, Manitoba, where the only specimen seen was collected by Mr. T. C. Weston in 1884.

MONTICULIPORA PARASITICA, Var. PLANA. (N. VAR.)

Plate VIII., figs. 3-3*d*.

The typical form of this species* may be described briefly as follows: Zoarium parasitic, forming thin crusts upon shells and *Streptelasma*, frequently consisting of several layers, each about one millimetre thick. Surface studded with small, abruptly elevated, conical monticules, arranged in decussating series, two to five mm. apart. Apices of monticules generally appearing solid, but, when in a good state of preservation, are occupied by a variable number (three to ten) of minute shallow cells. Zoœcia polygonal, thin-walled, with thirteen or fourteen of those of the ordinary size in three mm.; those surrounding the monticules are larger, some being three-tenths of a millimetre in diameter. Internally the zoœcial tubes exhibit complete series of cystiphragms, between two and three occurring in a space equal to the diameter of a tube. Walls minutely granular or punctate, rather thin, and usually enclosing a small lucid spot (acanthopore?) at the angles of junction.

The Manitoba variety differs from the typical examples of the species in being without monticules. On the other hand, the clusters of large cells are comparatively more conspicuous, some of them being at least four-tenths of a millimetre in diameter. In the minute internal structure they agree very closely. The peculiar structure of the zoœcial walls of true species of *Monticulipora* is shown very well in fig. 3*c*. The new variety is so far known only from a specimen collected by Mr. T. C. Weston at Stony Mountain in 1884. The original examples of *M. parasitica* were collected from the upper beds of the Hudson River or Cincinnati group at Oxford, Ohio. The species is now known

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***Monticulipora parasitica*, Ulrich. 1883. Journ. Cin. Soc. Nat. Hist., vol. 5, p. 238, pl. 10, figs. 3-3*a*.

from several localities in Ohio and Indiana, and a year or more ago it was found at a corresponding horizon in the Hudson River group at Wilmington and Savannah, Ill.

MONTICULIPORA WETHERBYI, Ulrich.

Monticulipora Wetherbyi, Ulrich, 1882, Journ. Cin. Soc. Nat. Hist., vol. 5, p. 239, pl. 10, fig. 4-4*b*.

Two examples of a species of *Monticulipora*, growing upon the frond of *Pachydictya magnipora*, (n. sp.,) occur among the material from St. Andrews. The surface of one of them was ground away, so as to exhibit fairly distinct tangential and vertical sections. As near as these permit me to determine, the specimens differ from the types of *M. Wetherbyi* (derived from the Birdseye limestone of central Kentucky) only in having the acanthopores somewhat less strongly developed. In other respects there seems to be perfect agreement.

St. Andrews, Manitoba, Dr. R. Bell, 1880.

HOMOTRYPA, Sp.

Four or five fragments of a smooth species of this prolific genus are contained in the Manitoba material before me. They are unquestionably identical with an undescribed form not unfrequently met with in the upper beds of the Hudson River or Cincinnati group at various localities in Ohio, Indiana and Illinois. Being closely related to other species, some of them also undescribed, I prefer to leave it unnamed until an opportunity is offered of describing its internal characters. Without good figures it might not be recognized, a remark which is peculiarly applicable to species of *Homotrypa*.

The Manitoba specimens were collected by Mr. A. McCharles at Stony Mountain, in 1884.

DIPLOTRYPA WESTONI. (N. Sp.)

Plate VIII., figs. 4-4*b*.

Of this peculiar species the specimen figured is the only one seen. It afforded the following characters: Zoarium a sub-hemispherical mass, about thirty-four mm. in diameter and twenty mm. high, with the lower side concave, and probably lined with an epitheca. The upper surface, though not well preserved, presents no indications of having been monticuliferous, but small "maculæ" or aggregations of mesopores were probably present. Zoœcia comparatively large, prismatic, with thin walls and polygonal apertures; twelve or thirteen of those of the average size in five mm. At intervals there are groups of larger size, many of them with a diameter of half a millimetre or more. These again usually enclose small and irregular clusters of mesopores, which vary greatly in size, some being quite as large as an average zoœcium. Their number in a given space is usually about equal to that of the zoœcia and, in this specimen, at any rate, are always distinguishable from them by being closed.

Vertical sections show an interesting though not unique feature, a similar peculiarity being characteristic of *Callopora* and one which has been noticed in certain species of *Monticulipora*, namely, that the proximal end of the tubes is, apparently always, crossed by numerous diaphragms whose development ceases suddenly, when the tube or cell may be said to assume the character of a true zoœcium. In the closely tabulated condition it must (as it appears to me) have existed as a "mesopore." The mesopore stage may have been relinquished at almost any height in the zoarium, yet it appears to have occurred simultaneously in nearly all the tubes, the sections showing rather sharply marked zones, the tubes in one being of nearly equal size and with few or no diaphragms, and in the next very unequal and mostly full of diaphragms. These zones are distinguishable even in fractures of the zoarium, the walls in the first being nearly smooth, while in the latter or closely tabulated region they are more or less wavy. In the specimen under consideration six alternating zones may be seen. Diaphragms and mesopores are abundant in the second, fourth and sixth, and few in the first, third and fifth. From this it follows that they represent respectively, what in my "American Palæozoic Bryozoa" is termed the "mature" and "immature" regions. This division of the zoarium into distinguishable zones is probably the most characteristic feature of the *Trepostomata*.

The only tangential section prepared exhibits the characters of the zoarium in its mature condition. Here the mesopores are distinguished from the zoœcia by being smaller, more irregular and of a darker hue than the zoœcia. Acanthopores seem entirely absent.

This species is more nearly related to the European *D. petropolitana*, Pander, than is any other form known to me from American deposits. They differ somewhat in the tabulation of the tubes.

Big Island, Lake Winnipeg, Mr. T. C. Weston, after whom the species is named.

The genus *Diplotrypa*, as now understood, embraces at least three small but well marked groups of species, each indicating relations to widely different families. The first or typical section, including, apparently, only *D. petropolitana*, *D. Westoni*, and one or two undescribed species, is characterized by comparatively large zoœcia, more or less wavy walls, and a resemblance to true species of *Monotrypa* (*e.g. M. undulata*, Nicholson and *M. subglobosa*, Ulrich) that, in my opinion, amounts to real affinity. *Monotrypa* itself comprises two very different sections, such species as *M. filiasa*, d'Orbigny, *M. petasiformis*, Nicholson, *M. irregularis*, Ulrich, and *M. monticula*, White, being true *Amplexoporidæ*, with very close relations to *Leptotrypa*, while the typical section of the genus presents no very great affinity with any of the families proposed by me.

Batostoma, a genus that has given me no little trouble to place, I am now convinced, is, (especially in its aberrant members, of which several are known to me) more intimately related to the typical sections of both *Diplotrypa* and *Monotrypa* than any of the others. The obvious relationship between these three groups strongly suggests the erection of a new family, which may be known as the *Diplotrypidæ*, the genus *Diplotrypa* being selected as the type. By establishing this family, three troublesome genera are satisfactorily placed, and the families comprised in the amended classification of the *Trepostomata* proposed in my forthcoming work on Illinois bryozoa assume a degree of definition and compactness which they would not possess otherwise. With this happy result comes another less fortunate, a reconstruction of *Diplotrypa* and *Monotrypa* being necessitated thereby. Thus, the second section of *Diplotrypa*, comprising *D. regularis*, Foord, *D. infida*, Ulrich, *D. patella*, Ulrich, (Rept. Ill. Geol. Sur., vol. VIII.) and, perhaps, *D. Whiteavesi*, Nicholson, approaches very near to *Prasopora*, and ought to go with the *Monticuliporidæ*. That disposition, however, would necessitate the adoption of one of two courses,—either a new genus would have to be established for their reception, or the species would have to be placed under *Prasopora*,—neither of which I am prepared to adopt. More study and very detailed comparisons are required before I shall consider myself justified in proposing a final arrangement. In the meantime it is best to leave these species with *Diplotrypa*. *D. Milleri*, Ulrich, a Niagara species with a decided leaning toward the *Calloporidae*, should likewise remain in its original association, while the same course may be pursued, provisionally, with the species at present referred to *Monotrypa*.

BATOSTOMA MANITOBENSE. (N. Sp.)

Plate 9, figs. 3-3c.

Zoarium irregularly ramose, branching at unequal intervals, diameter of branches varying between six and twelve mm. Surface nearly even, but exhibiting at intervals of about five mm. more or less conspicuous clusters of large cells. Zoœcia with broad-oval or sub-polygonal apertures, averaging three-tenths of a millimetre in diameter; those in the clusters attaining a diameter of half a millimetre. Over the spaces between the clusters the apertures of the zoœcia are ranged in moderately regular series, with about thirteen in five mm. When in a good state of preservation these apertures are surrounded by an exceedingly thin peristome, upon which an occasional very small acanthopore may be detected. The interspaces in this condition are slightly depressed with the mouths of the mesopores closed. As usual in species of this genus the number of mesopores varies greatly in different specimens. When they are the most abundant, then the apertures of the zoœcia are also the most rounded. When, on the other hand, the latter are more nearly polygonal, the mesopores are correspondingly few, and care must often be exercised or they may be overlooked.

In tangential sections, the minute structure appears to conform in every respect with the requirements of the genus, save that the acanthopores are unusually small. Just beneath the surface the mesopores are often nearly filled by deposits of sclerenchyma on the outer side of the zoœcial walls. In the average section, however, the ring-like walls of the zoœcia are rather thin, though much thicker than the partitions between contiguous mesopores. In some sections the acanthopores are very few, in others, one or two to each zoœcium.

Vertical sections show that in the axial region diaphragms are only developed at remote intervals, or they may be absent entirely, and that the tube walls are very thin, and often a little wavy. The tubes bend outward from the beginning and gradually become direct to the surface. As they approach the surface their walls become much thicker, and a greater or less number of mesopores and four or five or more diaphragms are developed. The latter are mostly less than a half tube diameter apart. In the mesopores six or seven diaphragms occur in a space equal to three-tenths of a millimetre.

Compared with other species, *B. Manitobense* is separated by the greater average number of mesopores, rounded apertures of the zoœcia, and the unusually inconspicuous acanthopores. *B. Jamesi* and *B. implicatum* (both Nicholson, sp.) have thicker walls and much larger and more numerous acanthopores. *B. irrasum*, Ulrich, from the Trenton shales of Minnesota, has larger acanthopores and usually fewer mesopores, and *B. fertile*, Ulrich, from the same locality and position, less ring-like and more polygonal zoœcia walls. All of these species differ also more or less in their vertical sections. *B. Girvanense*, Nicholson (sp.), appears to agree more closely than any of the others. It also has very small acanthopores, but they are more abundant. In comparing vertical sections *B. Manitobense* will be seen to differ in having much less numerous diaphragms in the axial region. It may be noted also that some examples (those having subpolygonal zoœcia) resemble *B. variabile*, Ulrich, while the surface of the typical form is much like that of certain species of *Trematopora* (e. g. *T. Halli*, Ulrich, and *T. calloporoidea*, Ulrich).

Several small examples are referred here provisionally. These fragments are only three or four mm. in diameter, but no conspicuous differences were noticed in thin sections.

Stony Mountain, Manitoba, Messrs. T. C. Weston and A. McCharles, 1884.

PETIGOPORA, Ulrich, 1882.

This genus includes small parasitic bryozoa, in which mesopores are absent but acanthopores are well developed. The zoœcia are polygonal, diaphragms are very few or absent, and the outer margin of the zoarium is usually formed by a narrow non-celluliferous band. That the affinities of the various species referred here are with *Dekayia* will, I think, scarcely admit of doubt. They might even be disposed of by regarding them as parasitic species of that genus. Still, as *Petigopora* complies with the real purpose of classification in being a convenient designation of a *natural* group of species, the name should be preserved. The group holds the same relation to *Dekayia* as *Leptotrypa* to *Amplexopora*, *Monotrypa* (*pars*) to *Monotrypella*, and *Heteroporella* to *Heteropora*. All these groups are not only convenient in classification but natural as well.

PETIGOPORA SCABIOSA. (N. Sp.)

(Not figured.)

Zoarium parasitic, forming subcircular or irregular crusts upon shells and other foreign bodies. Crusts small, slightly convex, thin and in the three specimens seen, vary in diameter from two and a half to eight mm. Surface even (*i.e.* without monticules), but in the largest example exhibiting clusters of cells of larger size than the average. Zoœcia polygonal, thin-walled, with about eight of those of the ordinary size in two mm. Acanthopores of moderate size, being smaller than those of *P. asperula*, Ulrich, and *P. petechialis*, Nicholson, and a little larger than those of *P. gregaria*, Ulrich. Most of the angles of junction between the zoœcia are occupied by them. Mesopores absent.

The result of my preliminary examination of these specimens was to refer them to *P. asperula*, but a careful comparison with the types of that form proves that they really belong to a distinct species. Indeed, *P. gregaria* seems to be still more nearly related to *P. scabiosa*, differing therefrom mainly in its flat or concave upper surface and slightly elevated marginal band. *P. asperula* has smaller zoœcia (eleven in two millimetres), a monticulated surface, and stronger acanthopores.

Stony Mountain, Manitoba, Dr. R. W. Ells, 1875, and Mr. T. C. Weston, 1884.

BATOSTOMELLA GRACILIS, Nicholson.

Chætetes gracilis, Nicholson, 1874, Quart. Journ. Geol. Soc. vol. 30, p. 504, pl. 29, figs. 7-7*a*.
" " " 1875, Pal. Ohio, vol. 2, p. 198, pl. 21, figs. 8-8*b*.
" " " 1876, Ann. and Mag. Nat. Hist., Ser. 4, vol. 28, p. 90, pl. 5, fig. 13.
Monticulipora (*Heterotrypa*) *gracilis*, Nicholson, 1881, genus *Monticulipora*, p. 125, fig. 20, and pl. 2, figs. 1-1*b*.

The typical form of this species is common at the tops of the hills about Cincinnati, Ohio, where it is restricted to a vertical range of about fifty feet. Nearly 300 feet higher in the series a slightly modified form reappears, differing from the typical one mainly in having the zoœcial walls somewhat thicker than usual. This variety, if it may be so called, has been found at Oxford, Ohio; Richmond, Ind.; Wilmington, Ill., and Spring Valley, Minn., and at all of these localities it occurs near the top of the Hudson River or Cincinnati group. Its geographical range is now extended to Manitoba, as I have recognized several fragments of it among the material collected at Stony Mountain, by Mr. T. C. Weston in 1884.

Bythopora ? delicatula, Nicholson.

Chætetes delicatula, Nicholson, 1875, Pal. Ohio, vol. 2, p. 199, pl. 21, figs. 9-9a.
" " Whiteaves, 1880, Geol. Sur. Can., Rep. Progr., 1878-79.

A single specimen of this species is attached to a slab collected at Stony Mountain in 1875, by Dr. R. W. Ells. The species is a common one in the upper beds of the Hudson River or Cincinnati group in Ohio and Indiana.

Bythopora striata. (N. Sp.)

(Not figured.)

This name is proposed for a species represented in the Manitoba collections and sometimes found associated with *B. delicatula*, Nicholson, at Middletown and other localities in Ohio, where the upper beds of the Hudson River group are exposed. The branches of its ramose zoarium are usually more slender than those of that species, being rarely more than one millimetre in diameter. They also bifurcate at shorter intervals, the length of the latter varying between two and four mm. The apertures of the zoœcia too, are more oblique and drawn out anteriorly, and are arranged between somewhat irregular rounded longitudinal ridges, with five or six in a space two mm. long. Ten to fourteen of the ridges suffice to encircle a branch. These ridges are strongest near the base of the zoarium, gradually fading away toward the growing extremities of the stems.

In *B. fruticosa*, Miller and Dyer, *B. arctipora*, Nicholson (species) *B. delicatula*, Nicholson, and other species known to me, an arrangement of the apertures of the zoœcia in diagonally intersecting series prevails, while in *B. striata*, near its base at any rate, the longitudinal arrangement is the most conspicuous.

The Manitoba specimen was collected by Dr. R. W. Ells at Stony Mountain in 1875.

Monotrypella quadrata, Rominger.

Chætetes quadrata, Rominger, 1866, Proc., Phila., Acad. Nat. Sci., p. 116.
" *rhombicus*, Nicholson, 1874, Quart. Journ. Geol. Soc., vol. 30, p. 507, pl. 29, figs. 11-11*b*.
" " " 1875, Pal. Ohio, vol. 2, p. 201, pl. 21, figs. 12-12*a*.
" " " 1876, Ann. and Mag. Nat. Hist., Ser. 4, vol. 18, p. 86, pl. 5, figs. 1-1*b*.

Monticulipora rectangularis, Whitfield, 1878, Annual Rep't. Wis. Geol. Sur., p. 70.
" " " 1882, Geol. Surv. Wis., vol. 4, p. 294, pl. 44, figs. 11-12.
" (*Monotrypa*) *quadrata*, Nicholson, 1881, genus *Monticulipora*, p. 179, fig. 36.

The collection contains several fragments of this highly characteristic and persistent species. It is not only an easily recognized form, but it is also to be found more or less abundantly wherever its proper horizon (the upper beds of the Hudson River or Cincinnati group) is exposed, making it an excellent guide in stratigraphical correlations.

The principal characters of the species are the thin walls and quadrate rhomboidal or hexagonal form of the zoœcia. In transverse sections of a branch the tubes are *always* largely four-sided.

The Manitoba specimens were collected by Mr. T. C. Weston at Stony Mountain in 1884.

FISTULIPORA ? LAXATA. (N. Sp.)

Pl. VIII., figs. 2, and 2*a*.

Zoarium massive, probably of hemispheric shape with the under side concave and covered with a wrinkled epitheca. The only specimen seen is a broken mass sixty mm. thick and about 120 mm. wide. From its shape I should judge its complete diameter to have been not less than 170 mm. The surface is too much weathered and obscured by adhering rock to show the minute superficial characters. Good thin sections, however, bring out the more important internal structure in a very satisfactory manner.

Transverse sections exhibit the usual characters of species of *Fistulipora*, only there is an unusual irregularity and *looseness* in the arrangement and size of both the zoœcia and interstitial vesicles. The zoœcia are irregularly ovate in cross-section and have thin walls. The lunarium, though never a very marked feature, is always determinable by the semi-circular shape of one-half of the circumference of the zooecium, the other half being, if not angular, at any rate always drawn to a circle of greater diameter than is the usually smaller and always more regularly curved lunarial side. A zoœcium of the average size measures about four-tenths of a millimetre in length by three-tenths of a millimetre in width; eight to ten occur in a distance of five mm. The vesicles vary greatly in size and distribution, some being very small and others as large and even larger than the zoœcia, and scarcely distinguishable from them. They form, generally, but a single series between the zoœcia, yet it is not uncommon to notice a double row for a short distance. An obscure radial arrangement is noticeable about certain points where the interstitial vesicles are more numerous than elsewhere, without, however, at any time, being in sufficient numbers to justify being called "maculæ." These are six mm or more apart.

Vertical sections are, perhaps, even more characteristic since in these the *loose construction* already mentioned is very striking. In these the zoœcia appear as long irregular tubes crossed at variable intervals (generally of one millimetre) by very delicate horizontal diaphragms; the vesicles assume all sorts of shapes, but are always remarkably high, and the walls between both the vesicles and the zoœcia have that peculiar granular structure noticed, in palæozoic bryozoa, only among the *Ceramoporidæ* and *Fistuliporidæ*.[*] The section also presents some evidence of minute connecting foramina in the walls between the zoœcia and vesicles.

In *F. laxata* I see what may be called the beginning of the *Fistuliporidæ*. As I have elsewhere stated, it is my belief that the *Fistuliporidæ* and *Ceramoporidæ* had a common origin, and in this species we see much to remind us of the latter group of bryozoa. Tangential sections of it are not much unlike those of certain species of *Ceramoporella*, but the long tubes shown in vertical sections and the, though rude, vesicular character of the interstitial spaces are important differences. As a rule the zoœcial tubes are short in the *Ceramoporidæ*, still in *Chiloporella*, *Anolotichia* and certain forms of *Crepipora*, they are long enough to bear comparison with *F. laxata*. It is with these, probably, that this prototype finds its nearest relatives, but *Ceramoporella* (despite the differences mentioned) may prove a closer ally.[†]

Since the above was written, I have had occasion to look over some of my unworked Minnesota bryozoa. Among the material I found several examples of a species differing in no respect from the Manitoba specimen described, save that the zoaria do not exceed seventy mm. in diameter and twenty mm. in height. These specimens enable me to add that the lunarium forms a prominent "lip" at the surface, and that here the vesicles are usually open—a feature probably due to attrition, since they are closed (*i.e.* the interstitial spaces appear solid) over the best preserved portions of one of the examples.

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[*] The "granular" structure of the walls in species of *Monticulipora* is different.

[†] A new genus ought, perhaps, to be established to include *F.? laxata* and one or two species known to me. Of the latter, one (a common form in the upper beds of the Hudson River or Cincinnati group at Wilmington, Ill.) is described provisionally as *Crepipora? epidermata* in my report on Bryozoa for vol. viii., Ill. Geol. Surv. Repts., now in press. I prefer, however, to await the completion of my studies in this large and difficult group before proposing the genus.

St. Andrews, Manitoba, where the type specimen was collected by Dr. R. Bell in 1880. The Minnesota examples are from the Trenton shales at Minneapolis, Minn.

STICTOPORA or RHINIDICTYA, sp. indt.

A fragment of a species of this genus occurs among the material collected by Mr. T. C. Weston at Stony Mountain in 1887. It is clearly identical with the species found near the top of the Hudson River or Cincinnati group at several localities in Ohio. The specific relation of these specimens is as yet doubtful. Careful comparisons with *S. Nicholsoni*, Ulrich, a common species from the Birdsëye limetone of Kentucky and elsewhere, and *S. mutabilis*, Ulrich, from the Trenton shales of Minnesota, and with another form (*Ptilodictya parallela*, James,) occurring rather rarely in the Utica horizon or lower beds of the Hudson River group, being necessary before they can be disposed of in a final manner. These species are all closely related to each other and to *S. fenestrata*, Hall, the type of *Stictopora*, as rewoked by me in the 14th Ann. Rep. Geol. Surv. Minn., 1886,[*] as well, and it is not possible in the present state of our knowledge to say what changes would result from a monographical study of the genus. In fact, the whole of the palæozoic bifoliate Bryozoa are sadly in need of revision. It is therefore deemed advisable to refer to the species in question as above.

That the form may be recognized by others, it is well to mention that the general aspect of the surface agrees very closely with that of *S. Nicholsoni* (*Rhinidictya Nicholsoni*, Ulrich), Jour. Cin. Soc. Nat. Hist., Vol. V., page 170, pl. 8, figs. 6-6*b*. The branches are 2·0 to 2·5 mm. wide, having nearly parallel margins, fourteen to eighteen rows of zoœcia, with thirteen in five mm. measuring longitudinally.

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[*] Since the publication of Vol. VI. Pal. N. Y.. 1887, in which Prof. Hall gives *S. elegantula* as the type of his genus, I have begun to realize that the claims of *S. fenestrata* to that distinction are not likely to meet with general approval. In that case, *Rhinidictya* might stand. The only objection to reinstating that generic name arises from the fact that in 1848, d'Orbigny proposed *Sulcopora* for *Stritopora fenestrata*, which species is most probably congeneric with *Rhinidictya Nicholsoni*. However, I for one. am not inclined to accept *Sulcopora*, nor *Subretepora* and *Ennallopora*, all founded by the same author upon nothing more than Hall's original figures and descriptions in Vol. I. Pal. N. Y. d'Orbigny's descriptions of these genera are not only vague and inadequate, but the very points mentioned by him are either not peculiar to the genera he sought to establish, or they actually do not exist in the original of the figures upon which he relied. Moreover, none of these generic names have been recognized by subsequent workers in the field, and I fail entirely to see what good could result from bringing them forward now after lying dormant for so many years. It would only add confusion to already complicated questions of synonymy.

DICRANOPORA FRAGILIS, Billings.

Ptilodictya fragilis, Billings. 1886. Catal. Sil. Fos. Antic., p. 9.
Stictopora fragilis, Whitfield. 1882. Geol. Surv. Wisc., vol. 4, p. 253, pl. 11, fig. 24.

This species, though never common, is to be found at many localities where the upper beds of the Hudson River or Cincinnati group (or their equivalents) are exposed. Several segments, more or less complete, were noticed on the slabs from Stony Mountain. The species may be recognized by the oblique direction of the two or three marginal rows of cells. The segments vary from six to ten mm. in length and 1·5 to 2·0 mm. in width, and have the upper or broadest extremity divided dichotomously. The branchlets are short and, when in a good state of preservation, have their extremities slightly thickened and solidified for articulation with the succeeding segment. The lower end of each segment is often obtusely pointed. There are eight to twelve rows of zoœcia on each face, of which the four or five central ones are arranged between low longitudinal ridges. On old examples, these ridges are finely granulose.

Collected by Mr. T. C. Weston in 1884.

DICRANOPORA EMACERATA, Nicholson.

Ptilodictya emacerata, Nicholson, 1875, Ann and Mag. Nat. Hist., sec. 4, vol. 15 p. 179, pl. 14, fig. 3-3*b*.
" " " " Pal., Ohio, vol. 2, p. 261, pl. 25, fig. 5-5*b*.

This species, represented in the Manitoba collection by a single imperfect segment, differs from *D. fragilis* in its smaller size, there being only from four to six rows of cells. The usual number is five, with one on each side oblique and the central rows longitudinal. The segments are also only about four mm. long and one millimetre or less wide. In other respects the species agree very closely.

The specimen is attached to a slab collected in 1884 by Mr. T. C. Weston at Stony Mountain.

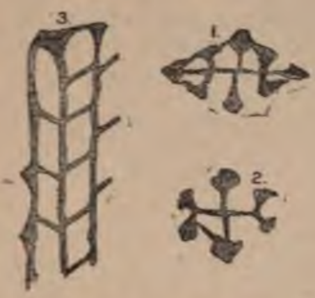
GONIOTRYPA, n. gen. (provisional).

Zoarium jointed; segments small, bifoliate, each face with a strongly elevated central ridge, imparting a lozenge-shape to the segments in cross-sections. Zoœcia ranged in longitudinal rows on each side of the median ridge, their apertures oval, and directed more or less obliquely outward.

This genus is proposed, provisionally, for the reception of the peculiar species next described. The genus has very close affinities with *Dicranopora*, and stands in precisely the same relation to that genus as does *Tæniopora*, Nicholson, to *Cystodictya*, Ulrich.

GONIOTRYPA BILATERALIS. (N. Sp.)

Plate IX., fig. 1.



1. Transverse section of a segment of *Goniotrypa bilateralis*, dividing it at a point about midway of its length. 2. Transverse section of the lower end of another segment in which, instead of non-celluliferous margins, there is a row of zoœcia on each side. 3. Tangential section of the upper half of a segment, showing the form of the primitive portion of the zoœcia, and the somewhat pinnate arrangement of the parts with respect to the median keel.

Segments simple, about one millimetre wide and four to six mm. long; lower extremity obtusely pointed; the upper truncate. Median ridges strongly elevated, delicate and sharp in young examples, rounded and somewhat granulo-striate in old specimens; zoœcia usually in four rows on each face with two on each side of the median ridges. A third row is occasionally developed along the sharp non-celluliferous margins. Apertures ovate, those of the cells in the outer row usually much larger than those of the inner. Frequently they are also separated by wider interspaces. Normally, however, the number in a given space should be nearly equal in the outer and inner rows. In the latter there are fourteen in four mm. Interspaces obscurely striated. A faint peristome generally surrounds the apertures of the zoœcia. The strong central ridges give the segments of this species such a distinct appearance that they are not likely to be confounded with the associated species of *Dicranopora*.

Stony Mountain, Manitoba, Dr. R. W. Ells, 1875, and Mr. T. C. Weston, 1884.

PACHYDICTYA HEXAGONALIS. (N. Sp.)

Plate IX., figs. 2-2c.

Zoarium, a bifoliate expansion of unknown dimensions. The fragment illustrated is two mm. thick. Surface nearly even. Apertures of the zoœcia mostly hexagonal, often quadrate or polygonal; arranged in rather irregular diagonally intersecting series, thirteen in five mm. At intervals of five mm. clusters of cells of slightly larger size than the average are formed. These are made more conspicuous by the thickening of the interspaces. The cells forming these clusters vary considerably in size, the largest being one-third larger than those of the ordinary size, while others are smaller than they. The interspaces are rounded and slope down into the apertures of the zoœcia, there being no sign of a peristome.

A vertical section shows that near the median laminæ the zoœcia are separated by exceedingly thin walls, that the vesicles are first developed after the tubes begin to bend outward (*i. e.* above the primary cell), that the vesicles thus cut impart an obscurely beaded character to the middle third of the height of an interstice, and that in the outer regions the vesicles are filled with solid tissue, in which exceedingly minute dots are closely ranged into vertical series, causing the tissue to appear vertically lined. The zoœcial tubes are crossed by from three to six unequally distributed diaphragms. The whole section has an unusually irregular aspect.

From a tangential section we learn that the primary cell, or that portion of the zoœcial tube which rests upon the median lamina, has very thin walls, is of oblong-quadrate shape, that its outline soon changes to lozenge-shape and then becomes elongate sub-hexagonal, with the anterior half rounded and the posterior half with the two sides and end slightly concave. Soon the posterior end is cut away and a vesicle formed, the opening now being of sub-circular form. After this the interspaces become thicker gradually, and at last solid with numerous minute dark spots. This I consider to have been the normal development of the zoarium, and all the stages described may be traced in a single judiciously prepared section. Such a section must cut the zoarium a little obliquely, so as to show its structure at various depths from the surface.

The development of the zoœcia, as above described, is very much as in certain species of *Ptilodictya* (*e. g. P. magnifica*, Miller and Dyer), but in that genus the interstitial spaces are always solid, and vertical sections could in no case be confounded with similar sections of *Pachydictya*.

P. hexagonalis differs from all the species of the genus in the superficial characters of the zoœcia, the sub-angular apertures and rounded interstices bringing to mind some of the monticuliporoids, or perhaps more still, such species of *Ptilodictya* as *P. pavonia*, d'Orbigny. *Pachydictya splendens*, Ulrich (Rept. Ill. Geol. Sur., vol. 8) from an equivalent horizon in Illinois I regard as a closely related species, differing mainly in having the apertures of the zoœcia arranged between fine longitudinal lines.

Stony Mountain, Manitoba, T. C. Weston, 1884.

PACHYDICTYA MAGNIPORA. (N. Sp.)

(Not figured.)

This species is founded upon a single example collected by Dr. R. Bell, in 1880, at St. Andrews, Manitoba, together with *Pachydictya acuta*, Hall, *Phylloporina Trentonensis*, Nicholson, sp., and *Monticulipora Wetherbyi*, Ulrich.

At first I thought it might be the same as the *P. Everetti*, Ulrich, (Ill. Geol. Sur. Rep't., vol. 8), but on comparing it with the types of that species it proved to have much larger zoœcia. The cells are, in fact, larger than in any other species of the genus known to me. *P. foliata*, Ulrich, from the Trenton shales of Minnesota, is probably its nearest congener. The following brief diagnosis will suffice for the recognition of the species:

Zoarium, a thin, slightly undulating, bifoliate expansion, attaining dimensions of probably forty or fifty mm. wide and as much or more high. At intervals of about five mm. the surface exhibits seemingly solid smooth spots or maculæ. Apertures of the zoœcia, oval, large, 0·64 mm. long, by 0·4 mm. wide, arranged in regular longitudinal and diagonally intersecting series, with seven or eight in five mm. longitudinally, and ten in the same space diagonally. This arrangement is not much disturbed by the maculæ. Many of the apertures are closed by a thin calcareous cover, in which I can detect, occasionally, a small central perforation. Interspaces flat or faintly concave, narrow, usually not more than one-third as wide as the apertures of the zoœcia. Internally the interspaces and maculæ are occupied by shallow vesicles. Median laminæ finely striated longitudinally and obscurely wrinkled transversely. The longitudinal striæ are very equal and represent the "median tubuli," which constitute such a characteristic feature of the *Stictoporidæ*.

PACHYDICTYA ACUTA, Hall.

Stictopora ? acuta, Hall, 1847, Pal. N.Y., vol. 1, p. 74, pl. 26, fig. 3*a*-3*b*.
Stictopora acuta, Ulrich, 1882, Jour. Cin. Soc. Nat. Hist., vol. 5, p. 168, pl. 8, fig. 1-1b.
Pachydictya acuta, Ulrich, 1886, 14th Ann. Rept. Minn. St. Geol, p. 67.

A fragment of this widely distributed species was collected by Dr. R. Bell, in 1880, from a cream coloured or buff limestone of the Trenton group at St. Andrews, Manitoba.

PTILODICTYA WHITEAVESI. (N. Sp.)

Pl. VIII., figs. 1-1*e*.

Zoarium consisting of a single unbranched, two-edged bifoliate frond, which is either a little curved or straight, and expands upward from the finely striated articulating "head." The central region of the frond is raised into a low broad ridge, and upon this the apertures of the zoœcia are ranged into seven or more moderately regular longitudinal series between more or less distinctly elevated longtitudinal lines. Young examples, like that represented by fig. 1*e*, have, with the exception of an oblique series along the sharp non-celluliferous border, only longitudinally arranged zoœcia. Fig. 1*d* represents an older specimen in which the frond has begun to widen, and fig. 1 is a restored representation of a fully matured example. At this stage of growth the surfaces on each side of the median ridge are slightly concave or flat, and upon them the apertures of the zoœcia are much less regularly arranged, these latter being also mostly of hexagonal shape. Somewhat irregularly distributed clusters of large cells constitute a marked superficial feature of these lateral areas. The largest cells in these clusters are 0·35 mm. in diameter, while the average diameter of the cells occupying the intermediate spaces is about 0·2 mm., there being about twelve of the latter in three mm. The zoœcia on the median ridges have oval apertures situated at the bottom of sloping areas of subquadrate outline; there between nine and ten occur in three mm. longitudinally, and nearly five of the rows in one millimetre transversely.

The internal characters, as brought out by tangential and vertical sections, are very well represented in figs. 1*b* and 1*c*. The vertical section shows that the superior hemiseptum is well developed and recurs at successive stages in the growth of the zoarium. A complete diaphragm also occasionally intersects the tubes near their mouths.

It gives me pleasure to associate with this species the name of Mr. J. F. Whiteaves, the palæontologist and zoologist to the Canadian Survey, to whom I am indebted for many favors.

Stony Mountain, Manitoba, Messrs. T. C. Weston and A. McCharles, 1884.

The position of *P. Whiteavesi* is, like that of *P. magnifica*, Miller and Dyer, intermediate between *P. maculata*, Ulrich, and *P. pavonia*, D'Orbigny, and such species of the more typical section of the genus, as *P. variabilis** and *P. plumaria*, James. The longitudinal arrangement of the zoœcia on the elevated median portion of the frond distinguishes it from the former species, while it agrees with them and differs from the latter group in having clusters of large cells, and in the circumstance that the apertures of the zoœcia are usually arranged in an intersecting manner over the lateral portions of the zoarium. Among species having hexagonal or rhomboidal zoœcia, *P. magnifica* forms a broad expansion, the surface of which is elevated at rythmical intervals into small conical monticules, the apices of which are generally solid. Similar monticules are present on *P. plumaria* and on old examples of *P. variabilis*. In all three of these closely related species the zoœcia are also a little smaller than those of *P. Whiteavesi*.

ARTHROCLEMA ANGULARE, Ulrich.

Arthroclema angulare, Ulrich, Rept. Ill. Geol. Sur., vol. 8, pl. 29, figs. 6-6*b* (in press.)

Several segments, agreeing closely with the Illinois types of this species, were noticed on slabs from Stony Mountain, collected by Dr. R. W. Ells in 1875 and by Mr. Weston, in 1884.

HELOPORA HARRISI, James.

Helopora harrisi, James, 1883, The Palæontologist, No. 7, p. 59, pl. 2, figs. 2-2*b*.

Associated with *Sceptropora facula* and *Arthoclema angulare*, I find a number of very slender segments of a jointed zoarium which, though not in a very good state of preservation, may still be referred to this species with much confidence. They are much more delicate than those of *Arthroclema angulare*, being about four mm. long and 0·25 mm. in diameter, with five or six rows of narrow elliptical zoœcia apertures. The species cannot be recognized from Mr. James' figures, but full illustrations will be found on plate 3 of my forthcoming report on Minnesota Bryozoa (Vol. III. Final Rep't. Geol. and Nat. Hist. Sur. of Minn.).

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* This name is proposed instead of *P. nodosa*, James, figured in my "American Palæozoic Bryozoa," (Jour. Cin. Soc. Nat. Hist., vol. 5, pl. 7, fig. 2), the specific name having been preoccupied by Hall in 1847 (*Escharopora nodosa*). The specimen figured by me is an old one, young examples being much more slender, and often entirely without monticules.

SCEPTROPORA, Ulrich.

Sceptropora, Ulrich, American Geologist, April, 1888, vol. 1, No. 4, p. 228.

This genus being founded upon specimens from Manitoba, I have thought it well to republish the descriptions given in the "American Geologist."

"Zoarium articulated; segments numerous, short, sceptre or club-shaped, the lower half striated, non-celluliferous, its extremity bulbous; upper half more or less expanded, celluliferous, and with a large socket at the centre of the top; occasionally with two sockets when the segment had articulated with two succeeding joints. Zoœcia sub-tubular, radially arranged about a central axis, their apertures subovate, and arranged between vertical lines."*

SCEPTROPORA FACULA, Ulrich.

Sceptropora facula, Ulrich. American Geologist, April, 1888, vol. 1, No. 4, p. 229.

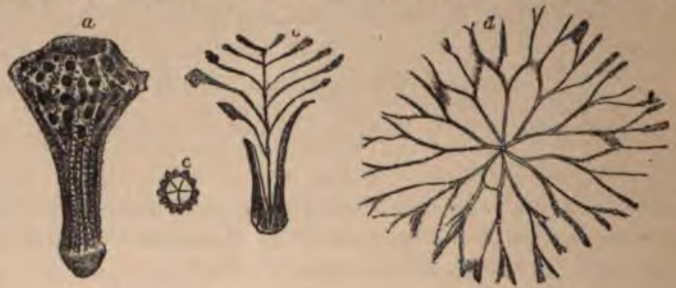

Fig. 2. *Sceptropora facula*, Ulrich, *a*, segment of the average size and appearance; *b*, vertical section of a segment, showing the tubular zoœcia and central axis; *c*, transverse section of the cylindrical lower half of a segment; *d*, transverse section of expanded portion of the largest segment seen. All magnified to eighteen diameters.

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*In looking over some of my collections from the Clinton at Hamilton, Ont., I was so fortunate as to find a number of segments of what will probably prove another species of this genus. They have a similar striated base, above which they expand rapidly into the shape of a short thick club. The top is rounded and, like the sides, covered with cell apertures. On young examples, some of which are comparatively slender, the apertures of the zoœcia are ranged in longitudinal series between granulose raised lines. As the diameter of the segments increases, these lines assume a zig-zag direction and new rows of zoœcia are interpolated, each placed so as to alternate with the old cells. The apertures are slightly oblique, of rounded form (sometimes nearly circular), and larger than those of the associated *Helopora fragilis*, Hall: there are three in one millimetre longitudinally. The segments vary in length from less than two mm. to more than four mm., and the diameter of the upper half from 0·5 to 1·8 mm. As this is an easily recognized and quite distinct species, I propose to call it, provisionally, *Sceptropora fustiformis*.

"Segments club-shaped, varying in length from less than one millimetre to nearly two mm.; lower half sub-cylindrical, about 0·23 mm. in diameter, non-celluliferous, covered with fine, granulose, vertical striæ; lower extremity bulbous, smooth; upper half celluliferous, expanding more or less rapidly, the depressed conical top varying in diameter from 0·7 to two mm. The apertures of the zoœcia on the top are sub-circular; about 0·09 mm. in diameter and arranged in radial series between raised lines about the large central socket. As the zoarium expands the series increase in number by interpolation. The apertures of the zoœcia on the sides are ovate and a little larger, having an average length of 0·11 mm. Like those on the top, they are arranged between elevated granulose ridges."

Detached segments of this very pretty little bryozoan are abundantly strewn over the surface of some of the slabs from Stony Mountain, Manitoba, and I do not doubt that if searched for, specimens preserving a number of them joined together would be found there. Such must be looked for in shaly layers only. Among the specimens from Savannah, Ill., there is one consisting of two segments still joined together. Those from Wilmington, Ill., consist of isolated segments. Here they are neither abundant nor easily detected, being readily overlooked because of their small size and the peculiar character of the rock.

NEMATOPORA (?) (N. Sp.)*

A fragment of what appears to be an undescribed species of this genus adheres to a small slab collected at Stony Mountain by Mr. T. C. Weston in 1884. It is five-sided and distinguished from all the species known to me in having the thin raised line bordering the two sides of the narrowly elliptical apertures of the zoœcia continuous from aperture to aperture. In the space between the ends of the mouths of the zoœcia these lines approach each other but do not unite, a narrow channel being left. I wish to see more specimens before proposing a specific name.

PHYLLOPORINA TRENTONENSIS, Nicholson.

Retepora Trentonensis, Nicholson. 1875. Pal. of the Province of Ontario, p. 15, pl. 2, figs. 4-4*b*.
" " Whiteaves. 1881, Geol. and Nat. Hist. Sur. Can., Rep. Prog. 1879-80, p. 58 c.
Phylloporina trentonensis, Ulrich. Rep'ts. Ill. Geol. Sur., vol. 8, pl. 53, fig. 1-1*c*.

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*This genus is proposed in vol. 8 of the Report of the Illinois Geological Survey (in press) for species of the type of *Helopora lineata*, Billings.

A good specimen of this species was found by Dr. R. Bell, at St. Andrews, Manitoba, in 1880, and its occurrence at this locality has been recorded by Mr. Whiteaves. It adheres to a fragment of white and buff mottled limestone, supposed to be from the same bed that furnished *Pachydictya magnipora*, *P. acuta*, *Fistulipora* (?) *laxata*, and *Monticulipora*, *Wetherbyi*. This bed would, I believe, yield handsome specimens of not only these but of many other bryozoa.

OSTRACODA.

The Ostracoda which form the subject of these notes were all, save one species, discovered on slabs of highly fossiliferous limestone, from Stony Mountain, Manitoba, in searching them for remains of bryozoa. They are, unfortunately, not in very good condition, nor are the specimens numerous. Indeed, the individuals are unusually few when we consider the number of species represented.

I am under great obligations to Prof. T. Rupert Jones, of London, England, our greatest authority on fossil ostracoda, for critical notes on the species.

BYTHOCYPRIS CYLINDRICA, Hall.

Pl. IX., fig. 6.

Leperditia (*Isochilina*) *cylindrica*. Hall, 1871. Desc. New Species of Fossils from the Hudson River Gr., etc., p. 7.
" " " Hall. 1872. 24th Rept. State Cab,, p. 230, pl. 8, fig. 12.
" " " Hall and Whitfield. 1875. Pal. Ohio, vol. 2, p 101, pl. 4, fig. 5.

One badly preserved valve appears to belong to this species. Its dorsal margin seems to have been more convex than usual, that edge being nearly straight in most specimens. As, however, in a few of the Ohio examples referred here, the dorsal line is even a little concave, the degree of curvature must be regarded as variable, unless future research proves that I have united more than one species under this name. Another specimen, having the dorsal margin rather strongly convex, was collected from near the top of the Hudson River or Cincinnati group, at Savannah, Ill.

Stony Mountain, Manitoba, T. C. Weston, 1884.

Perfect examples of this species from the lower beds of Cincinnati, Ohio, induce me to refer it to *Bythocypris*, Brady, since they resemble *B. testacella*, Jones, and *B. concinna*, Jones, very closely. One of the valves is a little larger than the other, and its edges overlap those of the smaller.

LEPERDITIA SUBCYLINDRICA. (N. Sp.)

Pl. IX., figs. 4-4*b*.

Valves rather strongly convex, elongate ovate, the posterior half a little the highest. End view sub-elliptical; edge view acutely elliptical. Anterior and posterior ends strongly and nearly equally rounded. Dorsal line straight, the ventral nearly so. Right valve larger than the left, and distinctly overlapping it along the ventral margin. Valves evenly convex; surface smooth, apparently without markings of any kind.

The only specimen seen gave the following measurements: greatest length, 2.1 mm.; greatest height (from posterior extremity of hinge line to ventral edge), one millimetre, height from anterior end of hinge line to ventral edge, 0.9 mm.; greatest convexity of the two valves in conjunction, 0.78 mm.

Stony Mountain, Manitoba: one specimen.

This species belongs to the group of "smooth Leperditiæ." Its small size will distinguish it from most of the lower palæozoic forms. *L. faba*, Hall, from the Niagara group of Indiana, is closely related to it, but differs in its form, being comparatively shorter and with more curved dorsal and ventral margins.

APARCHITES MINUTISSIMUS, Hall.

Leperditia (*Isochilina*) *minutissima*. Hall, 1871. Desc. New Species of Foss. from the Hudson River Gr., etc, p. 7.
" " " Hall. 1872, 24th Rep't. State Cab., p. 231, pl. 8, fig. 13.
" " " Hall and Whitfield. 1875. Pal. Ohio, vol. 2, p. 102, pl. 4, fig. 4.

A single valve from Stony Mountain is referred to this species, specimens of which are not uncommon at several horizons in the Hudson River or Cincinnati group of Ohio, Indiana, and Kentucky. A variety or very closely related species occurs in the Trenton shales of Minnesota.

The relations of this species are somewhat doubtful, still I believe we may assert with confidence that it is neither a *Leperditia* nor an *Isochilina*. It most probably belongs to the group of "nonsulcate Primitiæ", and, as Prof. T. Rupert Jones has just established the genus *Aparchites* for their reception, we cannot do better than place the species in it.

The convexity of the valves varies, the surface in some individuals being almost evenly convex, while in others it rises into an obtusely pointed subcentral prominence.

Stony Mountain, Manitoba, R. W. Ells, 1875.

APARCHITES UNICORNIS, Ulrich. (Var.)

Pl. IX., fig. 11.

Leperditia unicornis, Ulrich. 1879. Journ. Cin. Soc. Nat. Hist., vol 2, p. 10, pl. 7, figs. 4-4*b*.

A single valve which agrees too closely with *A. unicornis* to be distinguished therefrom specifically, adheres to one of the Stony Mountain slabs. It differs from the original examples of the species, which came from the lower or Utica horizon of the Hudson River or Cincinnati group, in having the two ends less equal and the spine a little stronger.

This species is not a *Leperditia*, as its valves meet without overlapping. There seems to be no reason for doubting that it is congeneric with the group of "nonsulcate Primitia," and should, therefore, be placed under the new genus *Ararchites*, Jones.

PRIMITIA LATIVIA. (N. Sp.)

Pl. IX., fig.

Valves rather strongly convex, suboval, slightly oblique, the height and length respectively, as nine is to thirteen. Ends nearly equally convex. Dorsal margin straight, its length equalling two-thirds that of the valve. Ventral margin convex, merging more gently into the posterior than into the anterior margin. Sulcus wide, strongly impressed, extending from the dorsal margin half way across the valve. Posterior border of sulcus more abrupt and more elevated than the anterior. Point of greatest convexity just below and a little behind the centre of the valve. End view of carapace ovate in outline. No distinct border is present, but the margin frequently flares a little.

Length of an average specimen, 1.35 mm.; height, 0.91 mm.; greatest convexity of the valve, 0.3 mm.

This is a true Primitia, with rather close relations to *P. bivertex*, Ulrich. The sulcus, however, is unusually wide, and that species has two strong nodes near the dorsal margin situated one on each side of the sulcus. Of European species *P. renulina*, *P. fabulina*, and certain varieties of *P. mundula*, all of Jones and Holl, should be compared with it. None of these species, however, have so wide a sulcus.

The species is represented by several valves attached to slabs of limestone from Stony Mountain, collected by Dr. Ells, in 1875 and by T. C. Weston in 1884, it also occurs in the upper beds of the Hudson River or Cincinnati group at several localities in southeastern Indiana. At a locality several miles north of Madison, Ind., several specimens were found associated with large numbers of *Leperditia cæcigena*, Miller.

PRIMITIA ? (? BEYRICHIA) PARALLELA. (N. sp.)

Pl. IX., figs. 7-7*a*.*

Valves oblong subquadrate, about twice as long as high, and moderately convex. Ends subequal, sometimes slightly truncate, the posterior one more blunt than the anterior. Dorsal and ventral margins nearly parallel. Anterior margin with a thick and strongly elevated border, extending slightly beyond the contact margin. Posterior margin also with a border, which is not nearly so much elevated there as at the anterior end, being in many cases almost flat. Along the ventral margin the border is obsolete. A well-marked sulcus extends from about the middle of the dorsal line to near the centre of the valve. At the posterior side of the sulcus a rounded node is more or less completely separated from the posterior lobe by a branch of the main sulcus. In a dorsal view the anterior lobe is very slightly more convex than the posterior, while the anterior border is quite as prominent. In an end view the point of greatest convexity is a little above the middle.

An average specimen gave the following measurements: greatest length, 0.8 mm.; greatest height, 0.4 mm.; greatest convexity of one valve, 0.13.

This species is represented in the Manitoba material before me by two imperfect valves. Fig. 7 (pl. IX), was intended to represent one of these, but it is now known that the illustration is faulty in failing to show an important feature, which, when added, gives it quite a different appearance.

Several years ago I washed a considerable quantity of shale from the upper beds of the Hudson River or Cincinnati group at Oxford, Ohio. The residue of these washings has as yet not been picked over, but a short time ago I spent an hour in looking over a small lot of the material, and found that it contained Ostracoda, among them the species under consideration. The specimens are a little smaller than the Manitoba ones, but their specific identity is scarcely to be questioned. The last fact, however, was not recognized by me till I began my final examination of the Manitoba specimens, preparatory to drawing up the descriptions. It was then noticed that a thick border, now crushed and partly worn away, actually existed at the anterior end of the valve from which fig. 7 was drawn. The posterior border is very faint in this specimen, having evidently also suffered through attrition.

The distinctive features of the species are (1) the absence of a border along the ventral margin and its development at the two ends, (2) the excessive development and prominence of the anterior border, and (3) the oblong shape and nearly parallel dorsal and ventral margins.

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*Fig. 7 is very faulty, having been drawn and lithographed from a crushed and macerated specimen before the much better examples from Ohio were seen.

I doubt very much that this is a true *Primitia*, but, as it seems more nearly related to some of the forms placed there by Prof. Jones than to the species of any other genus known to me, I thought it best to describe the species as above. It may be compared with some of the more simple forms of *Beyrichia*.

EURYCHILINA. (N. gen.)

Valves semicircular, suboval, or even nearly circular. Dorsal line straight. Generally with a well-defined sub-central sulcus and a more or less prominent node just behind it. A very broad convex border extends around the valves from the antero-dorsal to the postero-dorsal angle. The border is often striated in a radial manner and, in most cases, terminated by a marginal "frill," or by a plain narrow border, usually directed slightly outward. The main body of the border, however, curves inward to near the plane of contact between the two valves, thus forming a deeply concave outer area. Hingement simple. Surface reticulate, granulose, or smooth.

Type: *E. reticulata*, n. sp., from the Trenton shales of Minnesota.

This genus is related to *Primitia*, Jones and Holl, and to *Primitiopsis*, Jones. The possession of an internal concave marginal area separates it from the first, while the greater extension of the hollow area distinguishes it from the second. In *Primitiopsis* the marginal hollow is developed only at the anterior end.

Ten species and several varieties having the characters ascribed to the genus are known to me from American Cambro-Silurian deposits. Two of these are from the Chazy, three from the Birdseye, three from the Trenton, and two from the upper beds of the Hudson River or Cincinnati group. One of the last has been described by Mr S. A. Miller, under the name of *Beyrichia striatomarginata*. From sketches just received from Prof. Jones, it appears that *Primitia strangulata*, Salter, sp., should also be referred to *Eurychilina*.

EURYCHILINA RETICULATA. (N. Sp.)

Pl. IX., figs. 9, and 9*a*.

Valves nearly semicircular in outline, the curve of the anterior end being slightly less rapid than that of the posterior, and the height from the ventral edge to the straight dorsal margin a little greater than it would be if of true semicircular shape. Body of valves moderately convex, with the point of greatest convexity sub-central. Sulcus deep, beginning a little below the dorsal margin and extending half way across the body; its lower and posterior margins somewhat thickened and sharply defined. Surface, except along the dorsal line, beautifully reticulate. Marginal area wide, its width equal on the anterior and ventral sides: as it rounds up on the posterior end its breadth gradually diminishes till at the postero-dorsal angle it is scarcely more than one-fourth as wide as the antero-dorsal angle. As the area leaves the body of the valve it is convex, but soon the development of a radially marked "frill" makes it slightly concave. The "frill" is free only at its outer extremity, and this may be dentate, entire or terminated with a thickened rim, the variations probably following each other with age. In some examples the line of junction between the body of the valve and the marginal area is marked by a more or less strongly elevated thin ridge. In others there is simply an impressed suture line. The radial lines are strongest along the ventral edge and least distinct at the anterior end.

The interior shows that the width of the marginal hollow is equal to nearly one-fourth of the height of the entire valve, and that its outer edge curves inward nearly to the plane of contact between the two valves. The two sections shown in fig. 9*a* are faulty in representing the outer and lower extremity of the marginal areas as being simply thickened. The lower ends of the two sections ought really to have been represented by two diverging lines, with the inner one also more extended inward than now appears.

The dimensions of an average specimen are as follows: Greatest length of valve, including marginal area, 2.5 mm.; length of dorsal line, 2.3 mm.; greatest height of valve (across the posterior third), 1.4 mm.; length of body of valve, 1.8 mm.; greatest width of same, 1.0 mm.; greatest convexity of same (one valve), 0.25 mm.; width of marginal area at the anterior end, 0.47 mm.: width of same at the postero-dorsal angle, 0·12 mm.; width of ventral portion of marginal hollow (inner side of valve), 0.3 mm.

This species is distinguished from all the others known by its neatly reticulated surface. Separated valves are not uncommon in the Trenton shales at Minneapolis, St. Paul, Fountain and other localities in Minnesota. It is described in this connection because it is better adapted to stand as the type of the new genus, *Eurychilina*, than any of the others.

EURYCHILINA MANITOBENSIS. (N. Sp.)

Pl. IX., figs. 10, and 10*a*.

Valves smooth, semicircular in outline, the body very little convex, its two ends almost equal and forming nearly right angles with the straight dorsal line. Ventral margins of body and marginal area gently curved. Sulcus deep, well defined, situated just within the posterior half, and extending from the dorsal margin about half way across the body of the valve. Just below the sulcus the surface is somewhat elevated, and about midway of its length, on the posterior side, is a low rounded prominence which projects slightly into the sulcus. The marginal area is strongly convex, especially in the ventral region, being there also terminated by a narrow but sharply reflexed border. As the dorsal angles at each end are approached, this border is gradually lost in the general elevation of the area. On the interior, the marginal hollow does not extend to the dorsal angles, but reaches up on each side only about half the distance to the angles.

Greatest length of valve, including marginal area, 2.2 mm.; length of body of valve, 1.6 mm.; width of entire valve, 1.22 mm.: width of body of valve, 0.94 mm.; convexity of same, 0.18 mm.

This species is represented by two valves from Stony Mountain, one collected by Dr. Ells in 1875, and showing the exterior, the other by Mr. Weston in 1884, showing the interior. They resemble one of the Birdseye limestone species more than any of the others known to me. Prof. Jones suggests that it is comparable with *M. strangulata*, Salter, sp.

STREPULA QUADRILIRATA, Hall and Whitfield.

Pl. IX., fig. 12.

Beyrichia quadrilirata, Hall and Whitfield. 1875. Pal. Ohio, vol. 2, p. 105, pl. 4, figs. 6-7.

Of several hundred valves of this species examined by me none are as quadrangular in outline as that shown in the figure given by the authors of the species. Indeed, they are remarkably constant in their form, deviating but little in that respect from the example now figured on plate IX. These authors, it appears, failed also to notice the five pits along the anterior half of the free margin, which is a very characteristic feature of the species. The vertical plates which separate the pits often project beyond the depressed border of the valve, appearing in a view of the inner side like so many small spines.

A comparison between Hall and Whitfield's fig. 6 and fig. 12 on plate IX. of the present report shows other differences. In their figures, the depressed outer or contact margin is much narrower, and does not appear as overhung by the semicircular marginal ridge, nor is this ridge represented on the ventral side at all. Their view of a "basal profile outline" fits very well to their fig. 6, but is it true to nature?

When I first found specimens of this type and compared them with Hall and Whitfield's description and figures of their *Beyrichia quadrilirata*, I was struck by the differences here mentioned, and, naturally enough, believed I had found, if not a distinct species, at any rate a well-marked variety. Since then I have succeeded in collecting no less than fifty species of Ostracoda from the Hudson River or Cincinnati group, and still my collection is without an example of *B. quadrilirata* as originally figured and described. It would be strange indeed if, after all my search, this species should have been overlooked. Such an event, though possible, is not at all probable. I am, therefore, reluctantly obliged to believe that the discrepancies between the original figures and the specimens identified by collectors of Hudson River group fossils with *B. quadrilirata*, are really the result of imperfect observation. I would be very diffident about making this charge were I not able to prove inaccuracies in their figures of the much better known species *B. oculifera*, Hall, and *B. Chambersi*, Miller.

This species is one of the most abundant of the Ostracoda of the upper beds of the Hudson River group, and it occurs at many localities in Ohio and Indiana. I have collected it also at High Bridge, Ky., where it occurs in the Birdseye limestone, and from the Trenton shales at Minneapolis, Minn. The specimens from these lower horizons are almost identical with fig. 12, the modifications being too trivial to merit recognition here.

Figure 13, plate IX., represents a variety from Stony Mountain, Manitoba, that may be designated as var. *simplex*. It differs from the typical form in having the postero-median ridge simple instead of bifurcated below. The vertical plates which divide the anterior edge of the typical form into shallow cavities seem also not to have been developed except to a very limited extent. A very similar variety occurs in the Trenton shales of Minnesota.

In placing this and the following species in the genus *Strepula* of Jones and Holl, I follow the suggestion of Prof. Jones. While I agree with him in regarding this as the best arrangement possible at the present time, it is well to remark that there is something peculiarly distinctive about *S. concentrica* and *S. irregularis*, the typical species of the genus, that does not pertain to either *S. quadrilirata* or *S. lunatifera*.

STREPULA LUNATIFERA, N. Sp.

Pl. IX., figs. 14, and 14*b*.

Valves slightly elongate oval in outline, the posterior half generally a little the highest. Dorsal edge straight, one-fifth shorter than the length of the valve. Ends equally convex, rounding gently into the nearly straight ventral edge. Border strongly depressed, widest at the posterior end. Marginal ridge thin, abruptly elevated, running parallel with the border and overhanging it. Within the marginal ridge the surface is slightly depressed, with two nearly vertical thin ridges in the anterior half and two curved ones in the posterior. The latter unite at their ends and enclose a crescent-shaped concave space, the outer curve of which is almost parallel with the curve of the postero-ventral margin. These curved ridges often extend to and unite with the marginal ridge, and sometimes the upper end of the inner of the two anterior ridges is swollen and forms a more or less prominent node.

Dimensions of a large valve: greatest length, 1.55 mm.; greatest height, 0.87 mm.; greatest thickness of single valve, 0.32 mm. The Ohio specimens are usually a little smaller than this, their average length and height being, respectively, 1.25 and 0.7 mm.

This fine species is represented by a single valve on a small slab collected by Dr. R. W. Ells in 1875 at Stony Mountain, and a number of specimens picked from washings of shale of the upper beds of the Hudson River or Cincinnati group, at Oxford, Ohio. It is related to *S. quadrilirata*, Hall and Whitfield, but the two are not sufficiently similar to make confusion between them at all likely.

The following table has been prepared to shew the stratigraphical range of those Manitoba species which have been found also in the United States.

Species from Stony Mountain.	Trenton.......	Hudson River group.		
		Lower..	Middle.	Upper..
1. Proboscina auloporoides, Nicholson			*	*
2. P. frondosa, Nicholson			*	•
3. Monticulipora parasitica, Ulrich var				*
4. Homotrypa, sp. undescribed				*
5. Batostoma Manitobense, Ulrich				
6. Petigopora scabiosa, Ulrich				
7. Batostomella gracilis, Nicholson (var.)				*
8. Bythopora striata, Ulrich				*
9. B. ? delicatula, Nicholson				*
10. Monotrypella quadrata, Rominger				*
11. Stictopora, sp. undetermined				*
12. Dicranopora fragilis, Billings			*	*
13. D. emacerata, Nicholson				*
14. Goniotrypa bilateralis, Ulrich				
15. Pachydictya hexagonalis, Ulrich				
16. Ptilodictya Whiteavesi, Ulrich				
17. Arthroclema angulare, Ulrich				*
18. Helopora Harrisi, James				*
19. Sceptropora facula, Ulrich				•
20. Nematopora ? sp. undescribed				
21. Leperditia subcylindrica, Ulrich				
22. Aparchites minutissimus, Hall	*	*	*	*
23. A. unicornis, Ulrich (var.)		*		* ?
24. P. ? (Beyrichia) parallela, Ulrich				•
25. P. lativia, Ulrich				*
26. Eurychilina Manitobensis, Ulrich				
27. Strepula lunatifera, Ulrich				•
28 S. quadrilirata, var. simplex, Ulrich				
29. Bythocypris cylindrica, Hall	*	*	*	*
				20

Species from St. Andrews.	Birdseye and Black River.	Trenton ....
1. Monticulipora Wetherbyi, Ulrich	•	
2. Fistulipora (?) laxata, Ulrich		•
3. Pachydictya magnipora, Ulrich		
4. P. acuta, Hall	•	•
5. Phylloporina Trentonensis, Nicholson		•

Thus, out of 29 species from Stony Mountain, 20 are known to occur in the upper beds of the Hudson River or Cincinnati group at localities in the United States.

PLATE VIII.

Ptilodictya Whiteavesi, (page 44).

Figure 1.	Restored view of the specimen from which the thin sections were prepared. Natural size.
Figure 1*a*.	Portion of median ridge and lateral area of fig. 1, x 9, showing relative size and arrangement of apertures of the zoœcia.
Figure 1*b*.	Tangential section, x 18, showing the internal structure of a portion similar to that represented by fig. 1*a*.
Figure 1*c*.	Vertical section, x 18.
Figure 1*d*. " 1*e*.	Young examples of this species. Natural size.

Fistulipora (?) laxata, (page 37).

Figure 2.	Transverse section, x 18.
Figure 2*a*.	Vertical section, x 18.

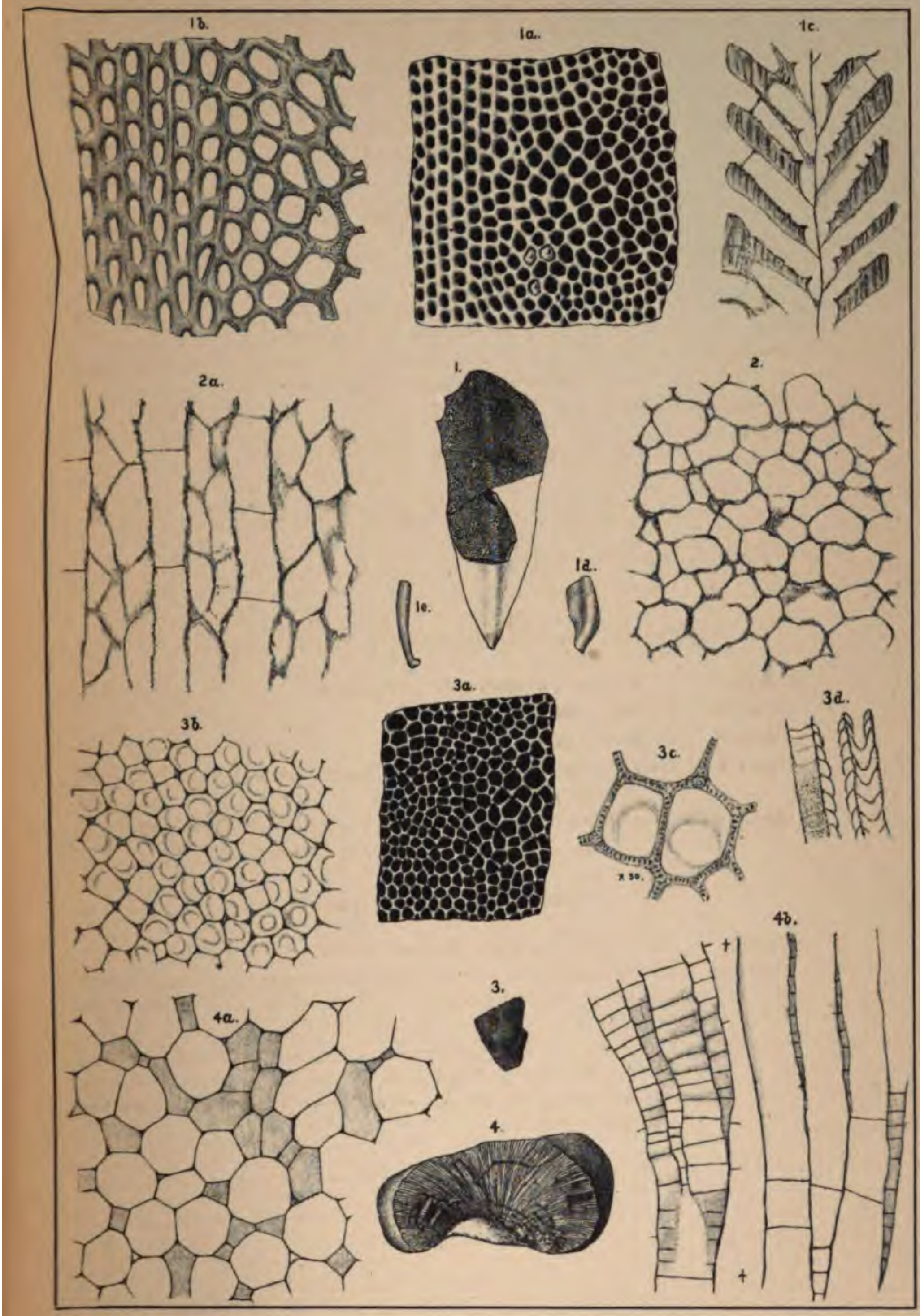
Monticulipora parasitica, var. plana, (page 29).

Figure 3.	View of the type specimen. Natural size.
Figure 3*a*.	Surface of the same, x 9.
Figure 3*b*.	Tangential section of same, x 18.
Figure 3*c*.	Portion of figure 3*b*, x 50, to show the peculiar structure of the walls in true species of *Monticulipora*.
Figure 3*d*.	Three tubes of a vertical section, x 18, showing the wall structure and varying appearance of the cystiphragms.

Diplotrypa Westoni, (page 30).

Figure 4.	Side view of the type specimen. Natural size.
Figure 4*a*.	Tangential section, x 18, showing relative side and arrangement of the zoœcia and mesopores, and one of the small clusters of the latter.
Figure 4*b*.	Two portions of a vertical section, x 18, that to the right showing the character of the tubes in one of the "immature" regions, and that to the left, one of the tubes followed up through the next region.

PLATE VIII.



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BRYOZOA

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PLATE IX.

GONIOTRYPA BILATERALIS, (page 41).

Figure 1.	Small segment of the natural size, and portion of same, x 18.

PACHYDICTYA HEXAGONALIS, (page 42).

Figure 2.	A fragment of the bifoliate zoarium of this species, of the natural size, showing the arrangement of the apertures of the zoœcia and clusters of large cells.
Figure 2*a*.	Portion of same, x 9.
Figure 2*b*.	Small portion of a vertical section, x 18, showing the tabulation of the zoœcial tubes, the interstitial vesicles, and the solid filling of the latter just below the surface.
Figure 2*c*.	Small portion of a tangential section, x 18. The upper end of the figure represents the appearance of the section when it passes through the zoarium at a depth from the surface equal to one-half of the thickness of one of its leaves. The lower end shows the character of the interspaces just beneath the surface.

BATOSTOMA MANITOBENSE, (page 39).

Figure 3.	Portion of the surface of a specimen with numerous mesopores, x 9.
Figure 3*a*.	Vertical section, x 18, showing the tabulation of the zoœcia and mesopores, and the thickened condition of their walls just beneath the surface.
Figure 3*b*.	Tangential section, x 18, showing the ring-like walls of the zoœcia, the number and distribution of the mesopores, and the inconspicuous character of the acanthopores of an average specimen.
Figure 3*c*.	Small portion of a tangential section, x 18, prepared from a specimen like that from which fig. 3 was drawn. In it, the zoœcia are more circular and their walls thinner than usual.

LEPERDITIA SUBCYLINDRICA, (page 49).

Figure 4.	View of the left side of a complete carapace, x 18, showing the overlapping edge of the right valve.
Figure 4*a*.	End view of the same, x 18.
Figure 4*b*.	Ventral profile view of the same in outline, x 18. The irregular line is intended to represent the overlapping edge of the right valve.

APARCHITES MINUTISSIMUS, (page 49).

Figure 5.	A right valve of this species, x 18, with the central region unusually prominent. Many specimens are simply strongly convex.

PLATE IX.—Continued.

BYTHOCYPRIS CYLINDRICA, (page 48).

Figure 6. A valve of this species, x 18, with the dorsal margin more convex than usual. This feature is slightly exaggerated in the drawing.

PRIMITIA ? (? BEYRICHIA) PARALLELA, (page 51).

Figure 7. This figure is faulty, but with several strokes of a pencil can be made approximately correct. The ends of a perfect valve are a little more obtuse than represented, but with that exception, the outline and the central portion of the figure are correct. What is lacking is a raised border or fold at each end. These may be supplied as follows: One mm. within the posterior (right) margin a heavy line should be drawn, curving slightly less rapidly than this end is shown to curve. A similar line should be drawn 1.5 mm. within the anterior margin, its curve to correspond with that of the anterior end of the figure. These lines must intersect the dorsal and ventral margins and, if correctly drawn, should cause the ends of the figure to appear elevated and separated from the suboval body of the valve by deep sulci.

Figure 7*a*. Sectional view of central portion of the valve, x 18, showing its convexity and the depth of the sulcus.

PRIMITIA LATIVIA, (page 50).

Figure 8. A left valve, x 18.

Figure 8*a*. Sectional view of the same, x 18, showing its convexity and depth of sulcus.

EURYCHILINA RETICULATA, (page 52).

Figure 9. Perfect right valve of this species, x 18, from the Trenton shales at Minneapolis, Minn.

Figure 9*a*. Two sections of different valves of the same, x 18. The lower end of these sections should have been made to bifurcate, and the concave line extended a little further inward.

EURYCHILINA MANITOBENSIS, (page 53).

Figure 10. Left valve of this species, x 18. The border at the upper left hand margin is represented as being decumbent, while this edge is slightly elevated in the specimen.

Figure 10*a*. Section of the same, showing its convexity and the shape of the marginal hollow.

PLATE IX.—Continued.

APARCHITES UNICORNIS, var. (page 50).

Figure 11. A valve of this species having the ends less equal than in the typical form, x 18.

STREPULA QUADRILIRATA, (page 54).

Figure 12. A perfect right valve of this species, x 18, from the Hudson River group at Clarksville, Ohio.

STREPULA QUADRILIRATA, var. SIMPLEX (page 55).

Figure 13. View of the only specimen of this variety seen, x 18.

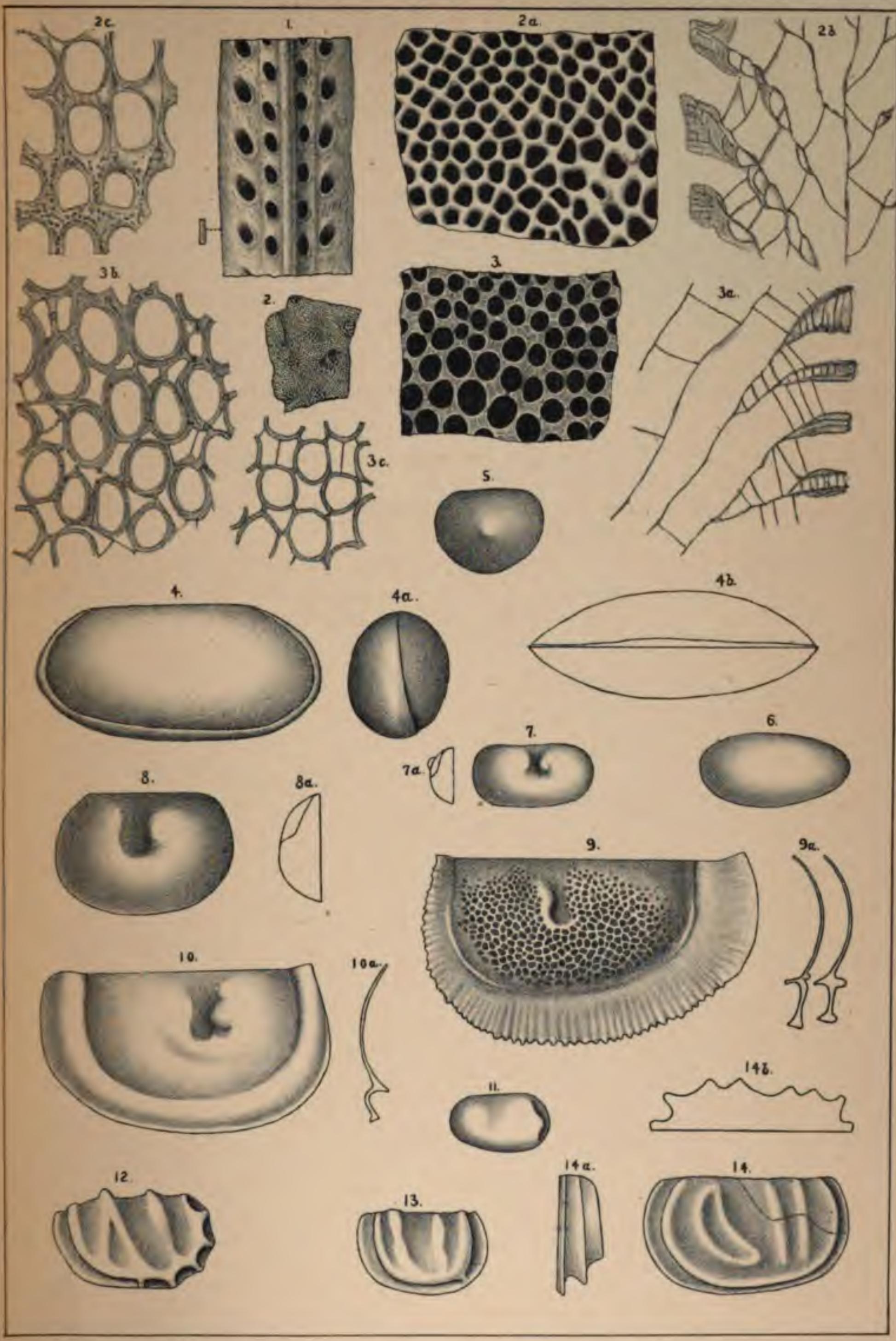
STREPULA LUNATIFERA, (page 56).

Figure 14. Large right valve, x 18, having the crescentic space separated from the marginal ridge.

Figure 14*a*. Posterior end view of the same.

Figure 14*b*. Longitudinal section of the same, showing the convexity of the valve and the elevation of the ridges.

PLATE IX.



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OSTRACODA
BRYOZOA

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GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

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CONTRIBUTIONS
TO
CANADIAN
MICRO-PALÆONTOLOGY.

PART III.

Ostracoda I.

BY

PROF. T. RUPERT JONES, F.R.S., F.G.S.

PUBLISHED BY AUTHORITY OF PARLIAMENT.

MONTREAL:
WILLIAM FOSTER BROWN & CO.
1891.

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(Canada)

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The title of the present volume having been found to be too restricted in its scope, it has been decided to change it from " Contributions to the Micro-Palæontology of the Cambro-Silurian Rocks of Canada," to " Contributions to Canadian Micro-Palæontology."

Part III., now presented, which has been kindly prepared by Prof. T. Rupert Jones, F.R.S., consists of an illustrated Report on Ostracoda from the Cambro-Silurian, Silurian and Devonian rocks at various localities in the Dominion, with a critical note on the species described by him in 1858, and figured in Decade 3 of " Canadian Organic Remains."

It contains forty-one pages of letter press, illustrated by four full page lithographic plates and five woodcuts. The pagination and the numbering of the plates have been made consecutive with those of Parts I. and II. by A. H. Foord and E. O. Ulrich.

Part IV., to be issued shortly, will consist of an illustrated Report on some Radiolaria from the Cretaceous rocks of Manitoba, collected by Mr. Tyrrell. For this Report the Survey is indebted to the kindness of Dr. D. Rüst, of Hanover, Germany.

ALFRED R. C. SELWYN.

GEOLOGICAL SURVEY DEPARTMENT,
OTTAWA, August, 1891.

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EXPLANATION OF PLATES X, XI, XII, XIII.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN MICRO-PALÆONTOLOGY.*

PART 3.

By Prof. T. Rupert Jones, F.R.S., F.G.S.

5. *On some Ostracoda from the Cambro-Silurian, Silurian, and Devonian rocks.*

INTRODUCTION.

Most of the specimens referred to in the present Report were collected by members of the Staff of the Geological Survey, at the localities and dates mentioned in the text, and were sent to Prof. T. Rupert Jones, F.R.S., for examination and study, in 1890 and 1891. A few, however, are from the private cabinets of W. R. Billings, T. W. E. Sowter, and Dr. G. J. Hinde.

In the Quarterly Journal of the Geological Society of London for November, 1890, Prof. Jones published preliminary notes on most of the species represented among the specimens sent to him prior to that date; but none of the species now reported on have hitherto been adequately described or figured, and many are now characterized and illustrated for the first time.

Under the three divisions A, B, and C the genera and species are arranged in an approximately natural order. It was at first intended to follow the same plan with the figures in the plates; uncertainty, however, as to the geological stages of some of the specimens in plate 10, in the first place interfered as to plates 10 and 11; and afterwards the acquisition of new material, which had to be shown in plates 12 and 13, made it necessary to place the species just as the convenience of figuring and the exigencies of circumstances allowed. Nor could the highly desirable plan of having a uniform scale throughout for magnifying the objects be adopted. The descriptions have taken a long time; but with this unavoidable delay many opportunities have arisen for the widening of experience, the collating of the results of other workers, and the forming of definite opinions—such, for instance, as relates to the evidence of Cambro-Silurian (Lower Silurian) forms being direct predecessors of Silurian (Upper Silurian) species. Nor are such links wanting between these Lower Palæozoic and some Upper Palæozoic species.

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* Being a continuation of the "Contributions to the Micro-Palæontology of the Cambro-Silurian rocks of Canada." It has been found desirable to alter the original title of the present volume and to enlarge its scope so as to include therein reports upon fossils of any age which require the use of the microscope for their examination.

There was at first considerable doubt as to the geological position of *Isochilina grandis*, var. *latimarginata* and its associates; but Mr. Tyrrell informed me, in January last, that "during the past summer a practically complete section has been obtained up the Saskatchewan River, showing that the Ostracod-bearing series overlies several hundred feet of Niagara Limestone, and on Lake Manitoba is overlain by a dolomite containing a few fossils that have been provisionally referred to the Guelph. The beds are also very similar in character to those in Wisconsin that contain *Leperditia alta*, and that have been referred by Prof. Chamberlin to the Lower Helderberg.

The Ostracodal beds of Lake Winnepegosis, therefore, have a taxonomic position somewhere between the upper beds of the Niagara and the Lower Helderberg."

Thus *Isochilina grandis*, var. *latimarginata* and the other Ostracods occurring with it belong either to the top of the Niagara or to the Lower Helderberg formation; both fossils and strata pointing in that direction.

The geological order of the localities from which the fossils herein described have been obtained is as follows:—

1. Black Island, Lake Winnipeg. Chazy.
2. Nepean, Ontario. Chazy.
3. Ottawa, Ontario. Chazy.
4. Drill Shed, Quebec. Chazy?
5. South of Montcalm Market, Quebec. Chazy?
6. Pointe-aux-Pins, Aylmer, Prov. of Quebec. Chazy.
7. Broad Street, Aylmer. Chazy.
8. Gloucester, Carleton Co., Ontario. Birdseye or Black-river.
7. Lorette Falls, River St. Charles. Trenton.

Cambro-Silurian.

10. **Jupiter River,** Anticosti. Clinton.			Silurian.
11. **Arisaig,** Nova Scotia. Clinton.			
12. **Durham,** Ontario. Guelph.			
13. **Foot** of Grand Rapids.		Saskatchewan Ostracodal series.	
14. **Grand** Rapids.			
15. **Roche** Rouge.			
16. **Chemahawin.**	On or about the same geological horizon, a little above that of Roche Rouge.		
17. **Cross** Lake Rapids.			
18. **Cedar** Lake.			
19. **Below** Cedar Lake.			
20. **Mossy** Portage.			
21. **Long** Point, northeast side of Lake Winnipegosis.			
22. **Island** Z, forty miles south of Long Point, Lake Winnipegosis.			Devonian.
23. **Island** on the southeast side of Dawson Bay, Lake Winnipegosis.			
24. **Athabasca** River.			
25. **Thedford,** Ontario.			
26. **Hay** River.			

A. FROM THE CAMBRO-SILURIAN ROCKS.

1. Aparchites mundulus (sp. nov.)

Plate 10, figs. 12 a and b.

Length 1·13 (hinge-line ·6), height ·86, thickness of carapace ·6, mm.

Subcircular, with a straight hinge-line [not so long as in the drawing, having been restored too boldly at the broken end], modifying the upper edge of the outline, which, if the curvature were continued, would be a short, broad oval. The free margin is almost symmetrically rounded. The surface is smooth and moderately convex. This sublenticular species closely approaches *Aparchites decoratus*, Jones (Ann. Mag. Nat. Hist., ser. 6, vol. IV, 1889, p. 272, pl. xv, fig. 12), from the Llandovery beds at Wisby, but it has a relatively longer hinge-line [though not so long as in the figure] than *A. decoratus*, no ornament, and rather less convexity.

I propose to name this *neatly* formed species Aparchites mundulus.

One specimen: so much imbedded that at first it was taken for a *Polycope*, see Quart. Jour. Geol. Soc., vol. XLVI, p. 553. From the dark grey, hard Trenton Limestone, with small organisms, at the Falls of Lorette,* on the River St. Charles, Province of Quebec, collected by Mr. H. M. Ami in 1888. A small but obscure allied form occurs also in the same limestone, with *Trinucleus concentricus* and *Ceraurus pleurexanthemus.*

A similar but smaller specimen, possibly a *Polycope*, is in fine-grained grey limestone (Chazy ?), Quebec City, where it was collected by Mr. H. M. Ami.

2. Aparchites Tyrrellii (sp. nov.).

Pl. 13, figs. 14 a, 14 b and c.

Length ·5 (hinge-line ·35), height ·32, thickness ·17, mm.

Many minute, suboviform ostracoda, the valves of which are represented by pyrites, are imbedded in a fine grained sandstone, with a siliceous cement. The matrix is grey and the valves dark olive; hence the stone is of a dark grey in colour; but weathers to a creamy white, the ostracods and other small fossils having disappeared, leaving the quartz grains translucent and the cement yellowish. The pyrites is partially decomposed here and there, and gives the usual taste of sulphate of iron. Some of the little ostracodous bodies appear of different shapes, on account of different degrees of imbedment. Some minute round bodies are probably other organisms.

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* For notes on the limestones in Quebec and at Lorette, see the "Geol. and Nat. Hist. Survey of Canada: Second Report on the Geology of a portion of the Province of Quebec." By R. W. Ells, LL.D., &c., 1888. Also, Mr. H. M. Ami's paper in the Bullet. Geol. Soc. America, vol. II, 1891.

The valves of the suboviform specimens show no evidence of overlap at their margins, even in natural sections; nor are there any real structural marks, either ocular or muscular, though occasional adhesions or abrasions give those appearances.

I name it after J. B. Tyrrell, Esq., M.A., B. Sc., F.G.S., of the Geological Survey of Canada, who collected it at Black Island,* Lake Winnipeg.

3. PRIMITIA LOGANI, Jones.

Beyrichia Logani, Jones. Ann. Mag. Nat. Hist., ser. 3, vol. I, 1858, p. 244, pl. ix, figs. 6-10 (including varieties); Geol. Surv. Canada, Org. Remains, Decade III, 1858, p. 91, pl. xi, figs. 1-5 (including varieties).
Primitia Logani, Jones and Holl. *A. M. N. H.*, ser. 3, vol. XVI, 1865, p. 417.
Primitia Logani, Jones. Proceed. Geol. Assoc., Pal. Biv. Entom., 1869, p. 13, figs. 3 and 4 (two varieties.)
Primitia mundula, var.; *P. mundula* (?); and *Primitia*, sp., Jones. Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 553.

This *Primitia* has characteristically a straight dorsal line, with the terminal angles recognizable, but not very strong; a convex ventral margin, often contracted in the antero-ventral region, so as to make the front moiety of the valves narrower (lower) than the hinder part, see Decade III, pl. xi, fig. 4 and especially fig. 5 (var. *leperditioides*). In some instances the curve of the ventral margin is very full (Decade III, pl. xi, fig. 1, var. *reniformis*, and fig. 2); in others (as in fig. 3) the ventral margin is nearly straight, and the valves are much like those of a long *P. mundula*. The surface is somewhat depressed, sometimes smooth, often punctate, and always impressed with the mid-dorsal furrow or short sulcus.

Primitiæ corresponding to *P. Logani*, with contracted antero-ventral region, as represented by fig 9, pl. v, and fig. 4, pl. xi, that is, more boat-shaped than oblong, occur in the Chazy shales (dark coloured, micaceous, shaly mudstone, somewhat ferruginous) at Broad street, Aylmer, Quebec; in the Trenton Limestone at the Lorette Falls, River St. Charles, and in Chazy (?) Limestone at Quebec, south of Montcalm Market, where they were collected by Messrs. Sowter and Ami.

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* See " Summary Report of the Geological Survey Department for the year 1890," 8vo Ottawa, 1891, p. 25. The fossiliferous rock referred to above belongs to the " considerable thickness of soft Palæozoic sandstones, apparently of the age of the Chazy (St. Peter's Sandstone) of Minnesota, which at the southwest end of the Island are found to run up comformably into the Trenton Limestone" (*loc. cit.*).

At first sight these and others, more or less obscured by imbedment or imperfection, passed for long varieties of *P. mundula*, but after prolonged and repeated examination they evidently fell into another group.

4. PRIMITIA MUNDULA, Jones. Var. EFFOSSA. (nov.).

Pl. 10, fig. 8.

Length 1·0 (hinge-line ·76), height ·6 mm.

Of the four or five *Primitiæ* in the dark, fine grained Chazy (?) limestone from the south of Montcalm Market, Quebec City (coll. Mr. H. M. Ami and Mr. N. J. Giroux), this is one of the least imbedded specimens, and has a simple, suboblong, bean-shaped form, straight on the back, fully rounded behind, but with a short, sloping curve in front, continued on the antero-ventral margin, so that the front is not quite so high as the hinder part of the valve. Surface smooth, impressed with a narrow dorsal sulcus, running into a large oval central pit, which has swollen sides. A narrow, flattened rim is traceable along the free margin much more distinctly in some specimens than in others.

This is related to both *Primitia Logani* and *P. mundula*, Jones, but its high convexity separates it from the former, and its relatively elongate shape, and its large oval pit and almost closed sulcus are features distinguishing it from the latter type and making it a noticeable variety. It may be known as *P. mundula, var.* EFFOSSA. It is referred to at p. 553, Quart. Jour. Geol. Soc., vol. XLVI.

A similar dark coloured, fine grained limestone near the Drill Shed in Quebec contains several small, obscure *Primitiæ*, which, perhaps, belong to *P. mundula*. These were collected by Mr. H. M. Ami, in 1888.

5. PRIMITIA MUNDULA, Jones. Var. INCISA (nov.).

Pl. 10, figs. 9 a, b, and c.

Length ·86 (hinge-line ·66), height ·53 mm.

In dark grey, hard Trenton Limestone (with encrinital joints and small brachiopods), from Lorette Falls on the River St. Charles, Province of Quebec, there are many small ostracoda, and among these are many varieties of *Primitia mundula.* Some are relatively longer and narrower than the type and approaching *P. Logani*, with the sulcus either mid-dorsal or nearer to one end.

Another variety, here figured (pl. x, fig. 9), is peculiar in having an obliquely triangular sulcus, with high sides, which make the valve very convex.

Although at first I thought these several forms might be of specific value (Quart. Jour. Geol. Soc., vol. XLVI, p. 553), it does not so appear to me now, and they will stand as noticeable varieties. This figured specimen may be called *var.* INCISA. Collected by Mr. H. M. Ami, in 1888.

6. BEYRICHIA CLAVIGERA (sp. nov.).

Pl. 11, fig. 7.

Beyrichia, sp. nov. Quart. Jour. Geol. Soc., vol. XLVII, 1890, p. 553.

Length 4·1 (hinge line 2·0), height 2·5 mm.

Subovate, with a straight, short hinge-line; broad-lobed; the two main lobes are of nearly equal bulk, but the hinder one is the larger of the two; they unite with a broad curved junction below; the middle lobe is isolated, of an irregular club-shape (reversed); a low, subsidiary ridge is just within the margin of the obliquely curved, projecting, posterior margin. Individuals vary in their proportions, besides being modified by pressure. Abundant in dark coloured, micaceous, shaly mudstone, somewhat ferruginous. Chazy Shales, Broad street, Aylmer, Quebec. Collected by Mr. T. W. E. Sowter.

7. BEYRICHIA CLAVIGERA (sp. nov.) Var. CLAVIFRACTA (nov.).

Pl. 11, fig. 8.

Length 3·4 (hinge-line 2·0), height 2·3 mm.

In this form the middle lobe is divided into two small lobes or tubercles, corresponding to the moieties above and below the constriction of the mid-lobe in fig. 7; and the upper part of the anterior lobe has developed a small tubercle; all the surface is punctate, and the posterior margin is not so oblique and projecting as in the type.

Accompanying the foregoing in the Chazy Shales of Aylmer, Quebec. Collected by Mr. T. W. E. Sowter.

8. BEYRICHIA QUADRIFIDA (sp. nov.).

Pl. 11, figs. 9 a and b.

Beyrichia, sp. nov. Quart. Jour. Geol. Soc., vol. XLVI, 1890, p. 553.

Length 1·3 (hinge-line 1·3), height ·8, thickness ·5 mm.

Semicircular on the ventral and straight on the dorsal margin; four-lobed, lobes narrow; the two behind are nearly equal in length, parallel, slightly curved upwards, joined below, and passing into the base of the front lobe, which, with the divided mid-lobe, is variable.

Though at first sight very different from *Beyrichia clavigera* (figs. 7 and 8), yet this form presents a passage from it to the four-ridged *Beyrichiæ* (plurijugatæ), to which Mr. E. O. Ulrich proposes to apply a distinct specific term. The definite, equal, parallel, narrow lobe in fig. 9 is a development of the subsidiary swelling behind the gigot-lobe in figs. 7 and 8, and, as in these latter, the midlobe forms two small, unequal and oblique lobes or tubercles, within the somewhat *Bollia*-like curve of the two chief lobes.

Rather frequent in a dark grey, hard limestone, (Trenton), with Ostracoda, encrinital remains, and brachiopod shells at Lorette Falls, River St. Charles, Province of Quebec. Collected by Mr. H. M. Ami in 1888.

9. ISOCHILINA OTTAWA, Jones.

Leperditia (*Isochilina*) *Ottawa*, Jones. Ann. Mag. Nat. Hist., ser. 3, vol. I, 1858, p. 248, pl. x, fig. 1.
—— —— —— Jones. Geol. Surv. Canada, Org. Rem., Decade III, 1858, p. 97, pl. xi, fig. 14.
Isochilina Ottawa, Jones. Ann. Mag. Nat. Hist., ser. 5, vol. XIV, 1884, p. 345.

VAR. INTERMEDIA (nov).

Pl. 10, figs. 10 a, b, and 11 a, b.

Isochilina Ottawa, Jones, var. Quart. Jour. Geol. Soc., vol. XLVI, 1890, p. 553.

	Mm.		Mm.		Mm.	
Fig. 10—Height	4½	(Hinge-line ..	3)	Height ..	2½	Var. *intermedia.*
Fig. 11————	4¾	(——	3½)	—— ..	3	
Fig. 1 (1858)—Height...	4	(——	3)	—— ..	2	Type.

Numerous individuals, in limestone belonging to the Chazy Formation, from Ottawa[*] and Nepean[†], Ontario, and Pointe-aux-Pins, Aylmer[‡], Province of Quebec, and constituting in each case nearly all the rock-mass, are very similar among themselves, and approximate closely to *Isochilina Ottawa*. There are some slight differences, however, from that species. The outline is not so oblong, the postero-dorsal angle being less prominent, and the antero-ventral margin rather less fully curved. The eye-spot is more isolated and distinct in some than in others, and the sulcus or depression behind it is variously developed, but always stronger than in the original specimens. The radiating vascular lines (seen only in the casts formerly) stream off backwards from the muscle-spot; otherwise the valves are smooth.

In shape some of these specimens (see figs. 10 and 11) approach *I. gracilis*, Jones, but the ventral margin is too boldly and deeply curved. The surface is not punctate, and individuals with pitted margins are rare.

As they agree with neither *I. Ottawa* nor *I. gracilis* in all respects, and come nearest to the former in shape, I regard them as representing an intermediate variety and call it *I. Ottawa* var. INTERMEDIA.

The species was first obtained from the Calciferous Sandrock at Grenville, and the Chazy Limestone of L'Original, in both instances forming an Isochilina-limestone, as at Ottawa, Nepean, and Aylmer. At L'Original and Grenville the individuals vary much in size, some having a length of six mm., others only three mm., and some are relatively shorter and higher than others. As it is so variable a species, we are not surprised at finding a noticeable variety with close affinities to the known types.

Isochilina gracilis, Jones (Ann. Mag. Nat. Hist., ser. 3, vol. I, 1858, p. 248, pl. x, fig. 2; Geol. Surv. Canada, Org. Rem., Decade III, 1858, p. 98, pl. ix, fig. 15), is more slender anteriorly than the variety *intermedia*, and much more so than *I. Ottawa*. It measures: Length, 3½ mm.; hinge-line, 2¾ mm.; height, 2 mm. (at the hinder moiety only). Its surface is more or less punctate, and its marginal lip is neatly pitted. The valves form a layer in the Birdseye Limestone, at the White Horse Rapids, Isle Jesus.

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[*] Abundant on the bed-planes of a piece of thin-bedded limestone, from a loose block in Sussex street, Ottawa, and probably belonging to the] upper part of the Chazy Formation (coll. Mr. H. M. Ami). Quart. Jour. Geol. Soc., vol. XLVI, 1890, p. 551.

[†] Constituting, with a few bivalve molluscs, the greater part of an easily broken grey limestone from Nepean, Ontario, belonging to the Chazy Formation (coll. Mr. H. M. Ami). *Op. cit.*, p. 551.

[‡] Abundant in a dark grey limestone of the Chazy Series (coll. Mr. T. W. E. Sowter). *Op. cit.*, p. 553).

10. ISOCHILINA WHITEAVESII (sp. nov.).

Pl. 10, figs. 13 a and b.

Length 2·0 (hinge-line 1·6), height 1·25 (less than in the drawing), thickness of carapace 1·1 mm.

Black, smooth, sublenticular, with straight dorsal and well curved ventral border (drawn too deep in fig. 12 a), ends boldly rounded, but not quite equally, the postero-dorsal angle being stronger than the other; convexity moderate, stronger in front than behind. A shallow subtriangular furrow on the front third of the dorsal region. At first sight it was thought to be an abnormal *Primitia*, (Quart. Journ. Geol. Soc., vol. XLVI, p. 552).

In general outline this specimen has some resemblance to *Aparchites Whiteavesii*, J. (Ann. Mag. Nat. Hist., ser. 6, vol. III, 1889, p. 384, pl xvii, fig. 10, and p. 385, woodcuts, figs. 5 and 6), from Manitoba, but it is more oblong, the hinder moiety extending farther backwards, its hinge-line being relatively longer, and more especially there being a dorsal depression, or feeble nuchal furrow, in the front moiety of the valve, like that in fig. 16 a, and pl. xi, fig. 16 a; the greatest convexity (fig. 13 b) is towards the front and below the sulcus at the same part of the valve as in fig. 10 b. The presence of a dorsal furrow separates this form from *Aparchites*, and, with the absence of ventral overlap, allows us to place it in *Isochilina*.

In shape this approaches *Primitia pusilla*, J. & H., 1865; but the latter is very small and depressed and has no dorsal angles.

As a new species I name this after the eminent paleontologist of the Geological Survey of Canada.

From the Trenton Limestone of Lorette Falls, River St. Charles, Province of Quebec, collected by Mr. H. M. Ami in 1888.

11. ISOCHILINA AMII (sp. nov.).

Pl. 10, figs. 14 a, 14 b.

Length 2·3 (hinge-line 1·5), height 1·5, thickness of carapace 1·0 mm.

A small black valve, ovate-oblong; dorsal border long and straight; anterior end evenly and posterior elliptically rounded; ventral edge neatly curved and obscurely crenulated. Surface marked with small scattered pits; greatest convexity at the hinder moiety.

This seems to differ from all known forms. It has the Leperditian shape of *Isochilina*, although no sulcus nor tubercle is visible, and may be named I. AMII, after Mr. H. M. Ami, M.A., F. G. S., of the Geological Survey of Canada, who has done much in furthering our study of the Palæozoic Ostracoda.

From the Trenton Limestone of Lorette, Province of Quebec, collected by Mr. H. M. Ami in 1888.

12. ISOCHILINA LABELLOSA (sp. nov.).

Pl. 10, figs. 16 a, b, c, 17, and 19.

Leperditia, sp. nov.? Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 553.

	Length,	(hinge-line,)	height,	thickness.
Fig. 16............ ...	1·2	(·86)	·86	·6 mm.
Fig. 17................	1·2	(·93)	·73	mm.
Fig. 19................	2·7			1·4 mm.

Small, dark coloured, convex carapaces, having the dorsal line straight and long, the greatest ventral curve in the middle or nearly so, the front end subangular and the hinder end well rounded. The greatest height and greatest thickness are a little behind the middle. These have a Leperditian form, with slight sulcus and tubercle in some, but none apparent in others. Though the individuals vary in relative proportions, they have the same characteristics as to general shape and conditions of the valves. They are proportionally longer than *Isochilina Whiteavesii*, (fig. 13 a,) and are narrower in front, with a shelving antero-ventral margin. Although so very Leperditian in shape, the valves meet ventrally without overlap, as in *Isochilina*; but the left valve is slightly thicker at its edge than the other. This feature, however, does not correspond with the overlap in *Leperditia*, as it is not on the overlapping valve of that genus. Having rather thick lips, this form may be termed I. LABELLOSA.

Abundant, especially on the bed-planes, in a black limestone of the Chazy Series, at Broad street, Aylmer, Quebec (figs. 16 and 17). Coll. Mr. T. W. E. Sowter. Also free specimens from the Bird's-eye and Black-river Limestone (see fig. 19), associated with *Tetradium fibratum*, *Orthoceras multicameratum*, *Bathyurus extans*, &c., at Lot 3, Concession 3, River Front 1, Gloucester Township, Co. Carleton, Ontario: where it was collected by Mr. W. R. Billings, of the Public Works Department, Ottawa.

13. LEPERDITIA BALTHICA (Hisinger), var. PRIMÆVA, (nov.).

Pl. 10, fig. 18.

Length 3·3 (hinge-line 2·3), height 2·3 mm.

This small *Leperditia* occurs with *Isochilina labellosa* in Carleton Co., Ontario. It was at first confused with the latter species; but, though much of the same shape, and with no external markings, it has a true Leperditian ventral edge, and is of large size. It is so much like *L. balthica* in its outline that I venture to regard it as an early representative or predecessor of that species.

14. LEPERDITIA (sp.). Woodcut, fig. 4. (Compare L. HISINGERI, Schmidt).

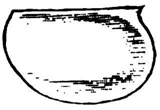

Fig. 4. *Leperditia*, cfr. *L. Hisingeri*, Schmidt. Side view of the cast of the interior of a left valve; much enlarged.

Leperditia ? Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 553, No. 2.

Length 3·0 (hinge-line 2·3), height 1·8 mm.

A single neat, somewhat compressed cast of the interior of the left valve of a small *Leperditia*, without any characteristic feature except its outline, the eye-spot, muscle-mark, and ventral flange not being shown. The greatest ventral curve is in the postero-ventral region. The postero-dorsal angle is very distinct, over a limited ogee curve. The front angle is broken off.

The outline is like that of *Leperditia Hisingeri*, Schmidt, as figured in the Ann. Mag. Nat. Hist., ser. 2, vol. XVII, 1856, pl. 7, fig. 3, and by Schmidt, Mém. Acad. Imp. Sc., sér. 7, vol. XXX, Miscell. Silur., 1883, p. 14, pl. 1, fig. 6. This species may probably have had representatives before the later Silurian period.

In dark-coloured, micaceous, shaly mudstone, somewhat ferruginous; Chazy Shales. Broad street, Aylmer, Quebec Province. Collected by Mr. T. W. E. Sowter.

15. LEPERDITIA (?) OBSCURA (sp. nov).

Pl. 10, figs. 15 a, b, and c.

Leperditia, sp. nov.? Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 553.

Length 2·7 (hinge-line 2·0), height 1·5, thickness 1·3 mm.

Oblong and Leperditian in shape, without apparent sulcus or tubercle, but with obscure indications of a ventral overlap. The ends are nearly equally rounded; ventral border gently curved; dorsal straight, with a long hinge line, and the postero-dorsal angle stronger than the front angle. Surface smooth, with the convexity greatest at the anterior moiety (see fig. 15 b). The ventral aspect of the carapace shows along the edge of the left valve, which lies uppermost, a narrow, flattened area, suited to receive the overlap of the right valve, as indicated by the diagrammatic outline of the junction, fig. 15 c. The test of the latter (larger) valve has disappeared, leaving only a rough and somewhat crenulated cast of the interior of its overlapping edge.

In outline this somewhat resembles the little *Aparchites matutinus*, J. and H., Ann. Mag. Nat. Hist., ser. 3, vol. XVI, 1865, p. 418, pl. viii, fig. 7, and at first sight it might, perhaps, be taken for Schmidt's *Leperditia Nordenskjoeldi*, Miscel. Silur. III, 1883, p. 25, pl. 1, fig. 31, but these differ in important particulars.

The specimen under notice was collected from the Trenton Limestone (dark grey and containing *Lituites undatus*) at the Falls of Lorette, Province of Quebec, by Mr. W. R. Billings, nephew of the late Mr. Elkanah Billings, and an ardent palæontologist.

B. FROM THE SILURIAN ROCKS.

1. PRIMITIA MUNDULA, Jones.

Beyrichia mundula, Jones. Ann. Mag. Nat. Hist., ser. 2, vol. XVI, 1855, p. 90, pl. v, fig. 23; p. 174, pl. xvi, figs. 28-31, and variety, fig. 26 ("*B. simplex*, var").

Primitia mundula, Jones and Holl. *Op. cit.*, ser. 3, vol. XVI, 1865, p. 419; ser. 6, vol. III, 1889, p. 376, fig. 2 (wood-cut), pl. xvi, figs. 6 and 9, pl. xvii, fig. 1, and p. 378 (varieties), pl. xvi, figs. 1, 4, 5, 7, and 8.

Primitia mundula, Jones. Proceed. Geol. Assoc., Pal. Biv. Entom, 1869, p. xiii, fig. 2 (a rather scaphoid form).

As mentioned in the Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 552, *Primitia mundula*, Jones, as a small variety, occurs in a limestone at Stonehouse Brook, Arisaig. This is probably the *Primitia* mentioned at p. 492, lines 38–41, *op. cit.*, vol. XXVI, 1870, but not the species referred to in lines 36–37.

Another *Primitia* is associated with it, namely, *Primitia ovata* (?), Jones and Holl, an obscure oval cast; probably the same form as that referred to in 'Geol. Mag.,' 1881, p. 344.

2. BEYRICHIA ÆQUILATERA, Hall.

Pl. 11, fig. 6.

Beyrichia equilatera, Hall. Canadian Naturalist and Geologist, vol. V, 1860, p. 158, fig. 20.

Beyrichia equilatera, Dawson. Acadian Geology, 2nd edit., 1868, p. 608, fig. 217; 3rd edit., 1878, p. 609, fig. 217.

Beyrichia æquilatera, Jones. Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 18, pl. ii, fig. 6, and p. 552.

Pl. 11, fig. 6. Length 1·5 (hinge-line 1·5), height 1·1.

Q. J. G. S., 1890, pl. ii, fig. 6: Length ·8 (hinge-line ·8), height .52 mm.

This is the best specimen of *B. æquilatera* (all casts) met with in the series sent by the Geological Survey of Canada for examination. Of its three lobes the smallest is in front and the largest (gigot) lobe is behind. The latter curves ventrally to meet the base of the middle lobe, and the front lobe curves away from the base of the last. Neither the posterior, nor either of the other lobes is sulcated. A broad, flattened area is distinct all round within the margin. There are two specimens like that figured in the Q. J. G. S., 1890, pl. ii, fig. 6, but differing slightly from it in the proportions of the lobes. I have not yet met with a specimen having a lobe quite divided into two parts, as in the woodcut, fig. 20, published in 1860. The fig. 6 just referred to has the third lobe slightly modified by a faint oblique sulcus, but it is not actually divided. It was kindly submitted for examination by Prof. R. P. Whitfield, of New York, and is labelled "*B. equilatera*." It is not, however, like the figure published in the "Canadian Naturalist and Geologist," 1860, which seems to have a strong curved ridge, a small central lobe, and two little lobes (not mentioned in the description) representing a third ridge. Indeed, the little woodcut (1860) here referred to has a relatively large, curved posterior lobe, a small isolated mid-lobe high up towards the back, and two separate small lobes anteriorly. Were it not that we have some *named* specimens from Arisaig and a special description at p. 198, "Canad. Nat. Geol.," 1860 (copied in "Acad. Geology," 1868 and 1878), we might think that this obscure little figure was intended for some such small form of *B. tuberculata* as the one shown in our fig. 1, pl. xi.

Dr. Honeyman mentioned this species in the Quart. Journ. Geol. Soc., vol. XX, 1864, p. 344, as occurring in his group D of the Arisaig strata. The original of pl. xi, fig. 6, is from Stonehouse Brook, Arisaig, Nova Scotia, in the limestone containing *Primitia mundula*, *P. ovata?*, and *Beyrichia tuberculata*.

We have here a rather difficult point to consider. Is the *description* or the *figure* given both by Prof. James Hall, in 1860, and repeated by Principal (now Sir W.) Dawson afterwards, to guide us as to the *species* with which these specimens are to be collocated? I think that really there is no doubt that the *figure* is that of a small *Beyrichia tuberculata*, or one of its varieties, and that the *description* is that of such a *Beyrichia* as has been sent labelled and named as *B. æquilatera*, and is figured in the Quart. Journ. Geol. Soc., 1890, pl. i, fig. 6, and in pl. xi, fig. 6 of the present paper; the only difference being that the middle lobe in the *description* is quite isolated, whereas in the figures here referred to—in the former it obscurely joins the ventral curvature of the front and hind lobes—and in the latter it quite unites therewith, bringing this form very near to *B. Klœdeni*. These three stages of difference may well be due to varying states of preservation in the specimens, as they are all *casts*.

The two separate lobules at one end of fig. 20, p. 158 (1860, and fig. 217, 1868 and 1878) do not belong to the *description* at all, but they definitely correspond to the same features in our pl. xi, fig. 1; so, also, the isolated and oval middle lobe, and the long, strong, curved posterior lobe of the same figure.

It will, I think, be most convenient to accept the published *description* (1860) as belonging to *B. æquilatera*, Hall, and to regard the little *woodcut* on the same page as belonging to the other species occurring so abundantly with *B. æquilatera*.

3. BEYRICHIA TUBERCULATA (Kloeden).

Pl. 11, fig. 3.

Battus tuberculatus, Kloeden (pars). Versteinerungen der Mark Brandenburg, 1834, p. 115–117, pl. i, figs. 21–23.

Beyrichia tuberculata, Boll. Palæontographica, vol. I, 1847, p. 127; Archiv des Vereins der Freunde der Naturgeschichte in Meklenburg; 16 Jahr., 1862, p. 119, pl. i, figs. 1 a, 1 b.

Agnostus tuberculatus, Quenstedt. Petrefactenkunde, 1852, p. 302, pl. xxiii, figs. 25–28.

Beyrichia tuberculata, Bronn and Roemer. Lethæa geognostica, 1854, vol. I, p. 536, pl. x^3, figs. 9 a–d.

Beyrichia tuberculata, Jones. Ann. Mag. Nat. Hist., ser. 2, vol. XVI, 1855, p. 86, pl. v, figs. 4-9 b; Proceed. Geol. Assoc., Pal. Biv. Entom., 1869, p. 12, figs. 12 a, b, c; Geol. Mag. Dec. 2, vol. III, 1881, p. 344, pl. x, figs. 8–10; Ann. Mag. Nat. Hist., ser. 6, vol. i, 1888, p. 402, pl. xxi, fig. 12.

Beyrichia tuberculata, Roemer. Lethæa palæozoica, 1876, pl. xix, figs. 9 a–d.

Beyrichia tuberculata, Krause. Zeitschr., d. Deutsch. geol. Gesell., vol. XXIX, 1877, p. 30, pl. i, figs. 12 a, b.

Beyrichia tuberculata, Hoernes. Palæontologie, 1884, p. 379, figs. 525 c. d.

Beyrichia tuberculata, Reuter. Zeitschr. d. D. g. Ges., vol. XXXVII, 1885, p. 632, pl. xxv, figs. 1 A, 1 B.

Beyrichia tuberculata, Zittel. Handb. Palæontol., vol. II, 1885, p. 553, figs. 739, 740.

Beyrichia tuberculata, Verworn. Zeitschr. d. D. g. Ges., 1887, p. 31, pl. iii, fig. 12.

Referring to the memoirs by Krause and Reuter, above noticed, the student will find the names of several other authors who have referred to this species, from either a geological or a paleontological point of view.

Several *varieties* of this species are noticed, and in many cases figured and named in some of the memoirs above enumerated.

It may be remarked here that the tubercles present on the surface of the lobes and margins of perfect valves are missing on casts of the insides, as is well shown among the figures on pl. x of the "Geol. Mag.," 1881.

Pl. xi, fig. 3. Length 4·5 (hinge line 4·3), height 2·7 mm.

This is much like Kloeden's "almost fully grown" type (*op. cit.*, 1834, pl. i, fig. 21), but the anterior lobe is more completely divided in our *cast*, the middle lobe is isolated, and the hinder lobe is less distinctly palmate. It is, also, to some extent, like one of Boll's typical figures (1862, fig. 1 b); but the oblique segments of the gigot (hinder) lobe of this internal cast show a more palmate arrangement, and not the quasi-spiral aspect that the outside of the valve usually suggests. It is like Krause's "third variety," *op. cit.*, 1877, p. 31, pl. ii, fig. 3, except that the margin and the divided front lobe are not tuberculate, our *casts* not having retained any evidence of the tubercles. Compare, also, Reuter's "*tuberculata-gibbosa*," *op. cit.*, 1885, p. 634, pl. xxv, fig. 2 A; this has tubercles on the lobes and margin, and the sausage-lobe is constricted, not divided. The ventral portion of the gigot-lobe in our fig. 3 shows some indication of at least two elevations or tubercles, hence this cast approaches still more nearly to *B. Bronni*, Reuter, *op. cit.*, p. 638, pl. xxv, figs. 6 A and 6 B, though no evidence of tubercles on the other lobes is visible. In fact the varietal gradations among the above-mentioned forms, and between them and others, are so numerous and shifting that I prefer to treat of the *cast*, fig. 3, as a representative of the type sufficiently good to bear its name.

From Stonehouse Brook, Arisaig, Nova Scotia, in dark-grey limestone, with hæmatitic stains, and made up of small organisms, such as the Ostracoda, together with 14 species * of mollusca, brachiopoda, and trilobites, and some encrinital remains. Upper Silurian (Upper-Ludlow) Formation. Dr. Honeyman's "Arisaig Group †, Division D". (Collected by Mr. Weston.)

There are also hollow casts of *B. tuberculata* and some varieties in the sandstone of the same formation at McAdam's Brook, Arisaig. See further on.

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* Determined by Mr. H. M. Ami, namely: *Murchisonia Arisaigensis*, Hall, *M. Nova-scotica*, H., *Nuculites erectus*, H., *N. cuneatus*, H., *N. subovatus*, H., *Megambonia cancellata*, H., *Pterinea*, sp., *Pholidops squamiformis*, H., *Lingula*, sp., *Rhynchonella*, sp., *Chonetes tenuistriata*, H., *Spirifera subsulcata*, var. *perlata*, H., *Crania Acadiensis*, H., *Calymene*, sp., *Dalmania Logani*, H., *Beyrichia pustulosa*, H., *Cornulites flexuosus*, H., var. *gracilis*, H.

† See Quart. Journ. Geol. Soc. vol. XX, 1864, pp. 333–345, and vol. XXVI, 1870, pp. 490–492; also 'Acadian Geology,' 3rd edit., 1878, pp. 565-570.

4. BEYRICHIA TUBERCULATA (Kloeden). Var. PUSTULOSA, Hall.

Pl. 11. fig. 2.

[illegible], Hall. Canad. Nat. Geol., vol. V, 1860, pp. 157, 158, fig. 19; Dawson, Acad. Geol., 2nd edit., 1868, and 3rd edit., 1878, pp. [illegible] fig. [illegible]

[illegible], Jones. Quart. Journ. Geol. Soc., vol. XXVI, 1870, p. 492; Geol. Mag., 1882, p. 544, pl. x, figs. 8, 9, and 10.

[illegible] Reuter. [illegible] vol. XXXVII, 1885, p. 640, pl. xxv, figs. 7 A, 7 B.

[illegible] var. [illegible], Hall. Jones, Q. J. G. S., vol. XLVI, 1890, [illegible] and p. 552.

Length [illegible] height [illegible] thickness of carapace 2 mm.

[illegible] 1890, is one of the Nova Scotian [illegible] is comparable with [illegible] anterior fourth by [illegible] makes a difference. [illegible] Mag., is partly broken [illegible]. As for the [illegible] shorter) to [illegible] specimen fig. [illegible] 1890, except that [illegible] is not at all an [illegible]. The [illegible] on the gigot [illegible]

[illegible] may be regarded as [illegible] fig. 1 a. [illegible] on the gigot. [illegible] and [illegible] fig. 2 a and [illegible] is not quite perfect [illegible] as a large growth [illegible] with the lower [illegible] J. Jones has a [illegible]

[illegible] B.

[illegible]

[illegible]

valve, it is near to Reuter's *B. Baueri* (*op. cit.*, 1885), but with fewer tubercles or pustules on the gigot lobe, there being only three instead of five or six.

Beyrichia pustulosa, Hall, as shown by the woodcut in the "Canad. Nat. Geol.," 1860, p. 158, fig. 19 (reproduced in the "Acadian Geology"), has the anterior lobe divided, the middle lobe isolated and the posterior lobe and its pustules represented by a broad, subtriangular gigot with four small tubercles. This lobe is described (p. 157) as being broadly curved and forming a ridge "high and angular, with a small prominent tubercle at the dorsal extremity, and from four to six smaller spine-like tubercles along its curve." In these features the valve closely resembles that of *B. Baueri*, Reuter, *op. cit.*, pl. xxv, fig. 7 B, and matches fig. 2 in pl. xi, except that the latter has its antero-ventral lobe hypertrophied (a feature of no essential value), and its tubercles do not exactly correspond with those in the little obscure woodcut.

The species is said (p. 158) to resemble very nearly the *B. tuberculata* (Kloeden), as described and figured in the "Ann. Mag. N. H.," 1855, but with some differences from it, and subject to slight variations of surface-markings.

As a name for this variety, that given by Prof. James Hall has precedence.

This form occurs in the limestone of Stonehouse Brook, referred to above, and in a brown ferruginous cavernous band or bed-plane in a dark grey micaceous sandstone, with casts of polyzoa, encrinital joints, brachiopods, trilobites, &c., from McAdam's Brook *, below the falls and fort, Arisaig, Nova Scotia. Dr. Honeyman's Division D.

5. BEYRICHIA TUBERCULATA (Kloeden). Var. STRICTISPIRALIS (nov).

Pl. 11, fig. 1.

Length 2·4 (hinge-line 2·0), height 1·7 mm.

This is essentially like one of Boll's typical figures, namely, fig. 1 b, pl. i, *op. cit.*, 1862, but its gigot lobe is narrow and has the look of being closely coiled or spiral, with three (instead of two) oblique sulci.

From Stonehouse Brook, Arisaig, Nova Scotia. In the same limestone as that already referred to.

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* See 'Quart. Journ. Geol. Soc.' vol. XX, p. 342.

6. BEYRICHIA TUBERCULATA (Kloeden). Var. NOETLINGI (Reuter).

Pl. 11, figs. 4 a, 4 b, 5.

Beyrichia Noetlingi, Reuter. Zeitschs. d. D. g. Ges., vol. XXXVII, 1885, p. 637, pl. xxv, figs. 5, A, 5 B.

Fig. 4, length 3·0 (hinge-line 2·7), height 1·8, thickness of carapace 1·5 mm.

Fig. 5, length 4·3 (hinge-line 4·2), height 2·5 mm.

Fig. 4 is nearest to *B. Noetlingi*, Reuter, *op. cit.*, fig. 5 A, in which the tubercles representing the gigot lobe are separate and form two rows. In fig. 4, however, the outer two tubercles coalesce, and are not divided.

In fig. 5 the tubercles constituting the gigot are evidently in two rows, but are not deeply divided one from the other. This specimen, also, seems to have had a supernumerary lobule (broken off) at the antero-dorsal angle, and its mid lobe shows a slight constriction at top.

From Stonehouse Brook, Arisaig, Nova Scotia, in the same limestone as the foregoing; also from McAdam's Brook, in the sandstone previously mentioned.

7. ISOCHILINA GRANDIS, Jones. Var. LATIMARGINATA (nov).

Pl. 10, figs. 1 a, b and c, 2 a, b and c, and 3, 4.

Leperditia marginata, Keyserling (?), Jones. Ann. Mag. Nat. Hist., ser. 2, vol. XVII, 1856, pp. 94 and 100, pl. vii, figs. 14 a-d.
Isochilina grandis, Schrenk, Jones. *Op. cit.*, ser. 5, vol. VIII, 1881, p. 347.
Isochilina grandis, Jones. *Op. cit.*, vol. IX, 1882, p. 171.

	Mm.		Mm.		Mm.		Mm.
Specimen not figured — Length	28	(hinge-line...	19),	height..	18,	thicknes of carapace..	10
Fig. 1—Length.....	11	(———......	15),	——..	13,	———	8
Fig. 2—Length.....	14	(———......	10),	——..	8,	———	6
Fig. 14 (1856) Length	18	(———	13),	——..	11½,	———	7

Carapace valves obliquely suboval, or, rather, ovate-oblong; convexity greatest in the anterior moiety, and lessening gradually backwards, but suddenly depressed at the anterior and ventral margins to form a flat marginal rim, which continues to the ends of the dorsal border, straight above, along the hinge-line, which is about two-thirds of the length of the valve, with its terminal angles well defined; elliptically curved below; ends rounded, narrower (lower) in front than behind, but a left valve, rather crushed, seems to have been less contracted at the antero-ventral margin.

The anterior or ocular tubercle is distinct in figs. 1 and 2, more prominent in a larger specimen, and less prominent in some other specimens; behind it is a sulcus, forking downwards; its hinder side is swollen in some degree, and between the fork is the relatively large, oval, convex muscle-spot. In some cases this shows an acutely-ovate area neatly reticulated (see fig. 3), and associated with a set of faint, radiating, slightly tortuous, vascular lines. In one instance the reticulation is obsolete, and the radii start from the sulcus, which is impressed with a row of minute oblong pits (fig. 4), bordering the lower edge of the oval tubercle. In the hollow moulds of the outside of the valve this has a granulate appearance, showing that the network had shallow pits between the meshes.

A somewhat similar sculpturing is figured by Dr. F. Schmidt, for *Leperditia grandis*, Schrenk, in his Memoir on Silurian *Leperditiæ* ("Mém. Acad. Imp. Sci. St.-Pétersbourg," sér. 7, vol. XXI, No. 2, 1873, pp. 10-12, figs. 3, 5 and 6, and by Barrande for his *Isochilina* (*Leperditia*) *formosa*, "Syst. Silur. Bohême," vol. I, Supplem, p. 534, pl. xxxiv, figs. 1-3, and *Isochilina* (*Leverd.*) *gigantea*,[*] *op. cit.*, p. 535, pl. xxxiv, figs. 4-6.

Of F Schmidt's figures of *L. grandis* (*loc. cit.*), fig. 5 is the most like our figs. 1 and 2, but there are characteristic differences in outline and contour.

Although no doubt exists of these valves (figs. 1-4), being of the same species with that figured and described by me in 1856, yet there is a slight variance. 1st. In outline, the specimen from Rupert's Land being rather more oblique by the downward and backward extension of the postero-ventral region. 2nd. In the ocular tubercle being stronger and more isolated in fig. 14 (1856) than even in fig. 2. 3rd. In the presence of a slight oblique furrow passing from the hinder edge of the sulcus to the middle of the posterior border. 4th. In the marginal rim not being so broad as in the specimens now figured. Hence it will be right to treat these latter as representing a *variety*, which may be called LATIMARGINATA.

Several specimens were collected by Mr. J. B. Tyrrell, in 1889, in the white limestone on the west side of Long Point on the east side of Lake Winnipegosis (or Winnipegoos), in lat. 52°55′ N. and long. 99°45′ W.

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[*] This is intended for F. Rœmer's *L. gigantea*, regarded by Barrande doubtfully as an *Isochilina*, but F. Schmidt (*loc. cit.*) states that Barrande's figure is not quite correctly restored, and that, the right valve slightly overlapping the left at the middle of the ventral edge, it is a *Leperditia*, and the same as Schrenk's *L. grandis*.

There are two other loose specimens from the harder cream-coloured limestone at the north end of Mossy Portage, Cedar Lake, collected by Mr. Tyrrell in 1890. These latter have the test preserved, but resembling the others.

The drawings of these specimens from the white limestone have been made from [illegible] plaster-casts of the natural hollow impressions (moulds) of the outsides of the valves, the artist having, also, the original specimens before him.

Specimens Nos. 1-4, from the east side of Lake Winnipegosis.
Specimen No. 1.—Hollow mould of a right valve. The plaster-cast is figured fig. 1.
——— No. 2.—Hollow mould of a left valve, not figured; rather yellowish.
——— No. 3.—Hollow mould of a right valve. The plaster-cast is figured fig. 2.
——— No. 4 a.—Hollow mould of a left valve, [illegible]; muscle-spot not quite visible.
——— No. 4 b.—Convex left valve. Test attenuated, probably by solution.
——— No. 5.—Convex left valve. Test present; muscle-spot good.
——— No. 6.—Hollow mould of a left valve, like No. 2. Muscle-spot figured fig. 4.
Specimens Nos. 7-8, from the north end of Mossy Portage, Cedar Lake.
Specimen No. 7.—Convex right valve, attenuated by solution. Muscle-spot figured fig. 5.
——— No. 8.—Convex left valve, attenuated by solution.

This species has been found also as follows:—A small specimen, not well exposed, about 7 mm. long, in a hard, rough, buff-coloured limestone, at Cross Lake Rapids (at the eastern end of the lake), on the Saskatchewan River east of Cedar Lake. Geological position a little above that of the Mossy Portage. These specimens, with some *Leperditia* [illegible] and many molluscs, in a white, hard, thin-bedded limestone from the Grand Rapids below Old Portage, near the mouth of the Saskatchewan. All collected by Mr. Tyrrell in 1890.

8. LEPERDITIA BALTICA (Hisinger), var. [illegible], Nov.

Pl. [illegible], figs. 12 a, b, 13 a, b, c.

Cytherina baltica, Hisinger. Anteckningar Phys. och Geogn. etc., vol. V, [illegible] Lethaea Suecica, 1837, p. [illegible], fig. 3.

Leperditia baltica, Jones. Ann. Mag. Nat. Hist., ser. 2, vol. XVII, 1856, p. [illegible] figs. [illegible] and 3.

Leperditia baltica, [illegible] Kolmodin, Bidrag till Kännedomen om Sveriges Siluriska Ostracoder, 1869, p. [illegible], figs. 1, 2, and 3.

Leperditia baltica, Schmidt. Mém. Acad. Imp. Sci., St. Petersbourg, Ser. 7, vol. XXXI, No. 2, 1875, p. 15; and *ibid.* vol. XXXI, no. 5, 1883, p. 11, pl. i, figs. 2 and 3.

	Length.	(hinge-line).	height.	thickness of carapace.	
Fig. 12........	10.7?	(8.7?)	7.	4.	mm.
Fig. 13........	8.6	7.	5.3	3.3	mm.
Baltic specimen, 1856	20.	(15.)	13.	9.	mm.

This has the usual Leperditian form; and, though half the size, closely resembles that of *Leperditia balthica*, especially the figures given by F. Schmidt, above-quoted. Our fig. 13 *a* represents a perfect small left (the overlapped) valve, having a rather more strictly oblique ventral margin, and with the submedial convexity rather lower down in the valve, than Schmidt's figs. 3 *a*, *b*; and it has a marginal thickening or narrow swelling at the posterior moiety of the hinge-line, somewhat like that in *L. gibbera*, Jones, but thinner and longer, being equal to a third of the valve's length.

Our figs. 12 *a*, *b*, of a right (the overlapping) valve of larger growth, though not in perfect preservation, show a thickening on the edge of the ventral margin, where it is turned in, and a rather bolder postero-ventral curvature than in either Schmidt's (1875), or my own figures (1856). In both fig. 12 and fig. 13 the eye-spot and its escutcheon, and the muscle-spot are very apparent. There is also a small left valve which is somewhat gibberous (slightly swollen at its dorsal edge.)

The relatively small size of these valves, the marginal thickening of the ventral border in one, and of the dorsal border in the other,—and the full postero-ventral curve of the right valve, though non-essential differences from the type, are worthy of notice,—and give cause for this form to be regarded as a *variety* (Var. GUELPHICA). It may be added that the strong backward and downward ventral curve approaches that of *L. Hisingeri*; but, there being no hollow ogee curve below the postero-dorsal angle, the hinge-line is relatively longer than in that species, and its proportion is thus kept nearer to that in *L. balthica*. The proportions closely approach those of some specimens of *L. gibbera*, Jones. The left valve of Baron von Toll's *L. Kotelnyensis*, Mém. Acad. Imp. Sci., St.-Pétersbourg, Ser. 7, vol. XXXVII, no. 3, 1889, p. 42, pl. iii, fig. 9 *a*, has much resemblance to our fig. 13 *a*; but it is longer, and its postero-ventral region is not nearly so full, nor so oblique. Both have a marginal thickening in the postero-dorsal region; but the posterior dorsal angle is much more pronounced in our figs. 12 and 13 than in von Toll's fig. 9 *a*.

A few specimens of casts of valves, retaining remnants of the test, from the Guelph Limestone of Durham, Ontario, have been supplied by Mr. Whiteaves for comparison. This is a cream-coloured limestone, and lies immediately on and conformable to the Niagara Limestone.

Another *Leperditia*, associated with the foregoing, seems to be a variety of *L. phaseolus* (Hisinger). See further on, page 86.

9. LEPERDITIA HISINGERI, Schmidt.

Pl. 13, figs. 1 and 9.

10. VARIETAS FABULINA, Nov.

Pl. 10, figs. 5 and 7; pl. 12, figs. 15; pl. 13, figs. 2, 3 and 5.

11. Var. GIBBERA, Nov.

Pl. 13. fig. 4.

12. Var. EGENA, Nov.

Pl. 12. fig. 8.

Cytherina balthica (part). Hisinger. Lethæa Suecica, 1837, p. 30, fig. 1.
Leperditia balthica (part), Jones. Ann. Mag. Nat. Hist. ser. 2, vol. XVII, 1856, p. 85, pl. vi. figs. 3 [illegible].
Leperditia balthica, var. b. Kolmodin. Bidrag till Kannedomen om Sveriges Siluriska Ostracoder. 1869. p. 14, figs. 4, 5.
Leperditia Hisingeri, Schmidt. Mém. Acad. Imp. St. Pétersbourg, ser. 7, vol. XXXI, No. 2. 1873. p. 16, figs. 22, 23: *Ibid.* vol. XXXI. No. 5, 1883, p. 14, pl. v. figs. 5-7.
Leperditia Schmidti, Kolmodin. Ofvers. k. Vet.-Akad. Forh. vol. XXXVI, 1880, p. 133.
Leperditia balthica, Jones. A. M. N. H., ser. v. vol. VIII, 1881, p. 333, pl. xix, figs. 10 and 11.

	Length.	hinge-line.	height.	thickness.	
L. Hisingeri (1883)	15.5	10.	11.5	7.	mm.
Pl. 10, fig. 5 ——	10.5	7.[illegible]	6.5	4.5	mm.
Pl. 10, fig. 7 ——	7.	5.	5.5	—	mm.
Pl. 12, fig. 15 ——	7.8	5.7	4.1	3.	mm.
Pl. 13, fig. 1 ——	8.7	5.7	5.7	3.7	mm.
Pl. 13, fig. 2 ——	4.8	3.3	2.5	—	mm.
Pl. 13, fig. 3 ——	6.8	5.	4.	2.6	mm.
Pl. 13, fig. 4 ——	5.5	3.6	[illegible]	—	mm.
Pl. 13, fig. 5 ——	4.	3.	2.5	—	mm.

Among the specimens which we have here figured several match some of Schmidt's figures of *L. Hisingeri*, and a few have almost the same outline. Thus though pl. xii, fig. 15 and pl. xiii, fig. 3 (two right valves) are not deep enough in the postero-ventral curve to match Schmidt's figs. 5, 6, and 11, pl. 1, 1883, yet pl. xiii, figs. 1, 2, and 5 of the left valve, match Schmidt's pl. 1, figs. 9 and 10; and our pl. xiii, fig. 9, is near Schmidt's pl. 1, fig. 12, though rather contracted in front.

L. Hisingeri is smaller than *L. balthica*, obliquely-subovate, and not suboblong like that species; it has a relatively shorter hinge-line, with strong dorsal angles, and a more obliquely-curved postero-ventral region than *L. balthica* shows.

Pl. xiii, figs. 1 and 9 correspond with the typical *L. Hisingeri* in these features. Several other individuals, for instance, pl. xiii, fig. 2, 3, and 5, approach closely to the foregoing in character, but have a rather longer hinge-line (var. FABULINA). In this respect, however, they are like some of Schmidt's figures of the species, Mém. Acad. Imp. St.-Pétersbourg, 1883, and may be retained as a variety under the specific name.

Pl. xiii, fig. 4, is an elongate, oblique, narrow, left valve, with its dorsal edge thickened for nearly all its length. We may call it var. GIBBERA. Fig. 9 of Baron von Toll's *L. Kotelnyensis*, already referred to (page 81), may be compared with our fig. 4; but the latter is much smaller, more oblique on the ventral margin, and has a relatively shorter hinge-line, and the dorsal thickening is longer and more distinct.

Pl. xii, fig. 15 pl. xiii, fig. 2 are from a soft yellowish limestone, with remains of Mollusca, at the foot of the Grand Rapids on the Saskatchewan River.

A small right valve, length 6· (hinge-line 4·5), height 4·, thickness 2·5, mm., not figured here, from Long Point, Lake Winnipegosis, is much like pl. xii. fig. 15, in shape, but rather smaller, and is scarcely distinguishable from *Leperditia Louckiana*, Jones (Ann. Mag. Nat. Hist. ser. 3, vol. II, 1858, p. 245, pl. ix, fig. 16), except that the postero ventral region is less obliquely projected and the hinder dorsal angle less marked in the latter. The outlines of pl. xiii, figs. 2, 3, and 5 are also much like that of *L. Louckiana*, but they differ from it as to the dorsal angles, and more or less in the antero-ventral slope; they are also too much rounded in front. From pl. x, fig. 5, it differs mainly in having a bolder and deeper curvature of the ventral margin.

Thus it is evident that *L. Louckiana* is nearly a prototype of the long-backed varieties of *L. Hisingeri*, just as *L. anticostiensis* and *L. amygdalina* are two allied predecessors of the short-backed forms.

Another specimen referable to *L. Hisingeri*, as one of its relatively long-backed forms that have a sufficient downward obliquity in the hinder moiety to separate them from *L. balthica*, is pl. x, fig. 5. It is comparable with pl. xiii, fig. 3, from the same locality, namely Long Point, Lake Winnipegosis. At first sight, pl. x, fig. 5, is not readily distinguishable from *L. fabulites* (*L. Josephiana*); but it is fuller in the antero-ventral outline. Indeed the specimens before us are not only higher (deeper) in the antero-ventral moiety, but have less postero-dorsal slope, are not quite so convex, and show usually some slight marginal rim.

This is No. 9 of the series, and was collected at Long Point on the east side of Lake Winnipegosis, by Mr. J. B. Tyrrell in 1889.

Other specimens collected by Mr. Tyrrell at the same time and place, and more or less closely resembling fig. 5, but differing in size, are:

			Mm.		Mm.		Mm.
No. 10	Left valve	Length	10½	(hinge-line	5½)	height	6¼
No. 11	Left valve	——	5½	(——	4)	——	3½
No. 13	Right valve	——	6	(——	3)	——	3
No. 14 (fig. 7)	Left valve	——	7	(——	4½)	——	4½
	Right valve	——	6½	(——	5)	——	4

In this case also we have evidence of an old prototype, or analogous predecessor, of a Silurian (Upper Silurian) species; both the older and the newer representative form having approximate varieties, peculiar to zones and localities.

From the white, hard, thin-bedded limestone at the Grand Rapids, another similar form occurs as casts, without any surface-marks, pl. xii, fig. 8 (x4). Its shape is nearly that of pl. xii, fig. 15 (x3), and pl. viii, fig. 3, (x3), but its bareness, its poor dorsal angles, and the absence of marginal rim, go far to distinguish it. This may be another variety [illegible] of Leperditia Hisingeri.

18. LEPERDITIA ALTA (?), Hall.

Pl. xiii, figs. 10, 11a, and 11b.

For the synonymy of and notes on this species see Quart. Journ. [illegible] pp. [illegible]

[illegible] in accordance with the figures and descriptions [illegible] referred to L. alta and abundant in the [illegible] (Lower Helderberg) of New York State. Pl. xiii, [illegible] limestone and though regarded [illegible] of the various published figures of [illegible] examination. Both fig. [illegible] fig. 11 (the right and larger valve) show the interior only, as usual on the slabs of the limestone. They are near to *L. Hisingeri* in outline, though the hinge-line is rather too long, and the antero-ventral margin has too full a curvature (compare fig. 9). The specimens figs. 10 and 11 are associated with *Klœdenia notata* in the black Tentaculite limestone of Schoharie, State of New York. Collected by Dr. G. J. Hinde, F.G.S. They were chosen for illustration here because of the neat crenulation within the dorsal margin (hinge-line) of each valve, which feature corresponds with the delicate and fainter crenulation seen on the outside of the dorsal margin, in figs. 9 a and 9 b, of *L. Hisingeri* from Long Point, Lake Winnepegosis. An analogous crenulation is shewn in Kolmodin's figures of *L. phaseolus*, Öfversight, etc., 1880, pl. xix, figs. 4 b and c.

It seems to me that more than one species has been included under *L. alta*, and that some at least of the published figures show a varietal relationship to *L. Hisingeri*.

14. LEPERDITIA PHASEOLUS (Hisinger.)

Pl. 13, figs. 7 and 8.

Cytherina phaseolus, Hisinger. Anteckn. Phys. Geogn., vol. V, 1831, pp. 110-135, pl. viii, fig. 3; Lethœa Suecica; 1837, p. 9, pl. i, fig. 1.

Leperditia Angelini, Schmidt. Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 7, vol. XXI, No. 2, 1873, p. 13. figs. 13-18.

Leperditia phaseolus, Kolmodin. Ofvers, k. Vet.-Akad. Förhandl., vol. XXXVI, 1880, p. 134, pl. xix, figs. 4 and 5.

Leperditia phaseolus, Schmidt. Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 7, vol. XXXI, No. 5, 1883, p. 9.

	Length, mm.	(hinge-line), mm.	height, mm.	thickness. mm.
Pl. 13, fig. 7........	12·	(8·2)	7·	4·6
Pl. 13, fig. 8........	11·	(6·)		
Kolmodin's pl. 19, fig 4........	12·5	About ¾ths the length of the valve.		
Kolmodin's pl. 19, fig 5........	14·			

Pl. 13, figs. 7 and 8 are more like Kolmodin's fig. 4 *b* than his other figures, as to the ends of the hinge-line, and like his 5 *b* in the more equal curvature of the ventral border.

The typical *L. phaseolus* is smaller and relatively longer than *L. Hisingeri*, having less ventral depth. Our specimens, figs. 7 and 8, which approach *L. phaseolus*, have a more equal or symmetrical ventral curvature than the type. The specimen shewn by the woodcut of *L. phaseolus*, var. *Guelphica*, the form (No. 15) next to be considered, has moreover a greater height from the ventral to the dorsal border, and it may be regarded as a recognizable variety.

Among the specimens from Roche Rouge, Saskatchewan River, between Cross Lake and Lake Winnipeg are—(1) several individuals of *Isochilina grandis*, var. *latimarginata*, in a thin-bedded, yellowish limestone, weathering white; (2 and 3) the specimens figured on pl. xiii, figs. 7 and 8, in a buff-coloured, hard, rough limestone; and in the same limestone a more broadly-ovate *Leperditia*, not well exposed, but perhaps like pl. xiii, fig. 1. The geological position of these specimens is above those at the foot of the Grand Rapids. Collected by Mr. Tyrrell, August 27, 1890.

13. LEPERDITIA PHASEOLUS (Hisinger). VAR. GUELPHICA, nov.

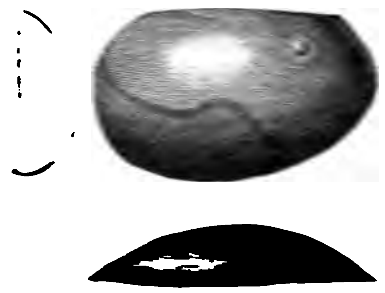

Fig. 13. [illegible] Durham, Ont. [illegible]

[illegible] 5·3 mm.

[illegible] being deeper from [illegible] approximate [illegible] pl. xix, fig. [illegible] margin.

[illegible] var. [illegible]

[illegible] Schmidt.

[illegible]

[illegible] St.-Petersbourg, Ser. [illegible] vol. XXXI, [illegible]

[illegible] 3 mm.

[illegible] fig. [illegible] and fig.

14 (1883) agree best with our fig. 6 *a*. Other forms described by Schmidt from the Russian territory vary from oblong to subovate. They were from the Upper Silurian dolomitic limestone near the mouth of the Waschkina River, in the Timantundra, bordering the Arctic Ocean.

It is difficult to discriminate the specimen under notice from *Leperditia labrosa*, Jones (Ann. Mag. N. H., ser. 3, vol. I, 1858, p. 245, pl. ix, fig. 13), belonging to the Calciferous Sandrock of Canada; but in this latter the marginal rim is wider and the convexity greater; and it certainly indicates a very similar, and so far an analogous form having existed in still earlier times.

From the white limestone of the west side of Long Point on the east side of Lake Winnepegosis, collected by Mr. J. B. Tyrrell in 1889.

There is some resemblance in both *L labrosa* and the present specimen, fig. 6, to the drawing of a young individual of the Scandinavian *L grandis*, Schrenk, given by Schmidt in the Mém. Acad. Imp. Sci., St. Pétersbourg, ser. vii, vol. xxi, No. 2, 1873, p. 10, fig. 6.

17. LEPERDITIA WHITEAVESII, sp. nov.

Pl. 12, figs. 11, 12, 13, 14, and woodcut fig. 6.

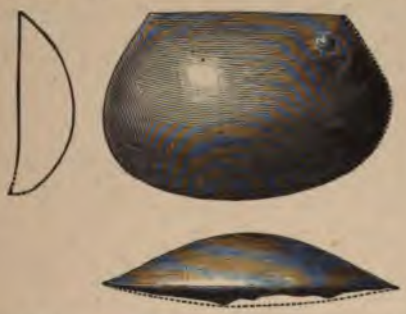

Fig. 6. *Leperditia Whiteavesii*, nov. (Interior extremity damaged.) Chemahawin, Saskatchewan River. Magnified $\frac{4}{1}$.

	Length, mm.	[illegible]hinge-line), mm.	height, mm.	thickness. mm.
Pl. 12, fig. 11........	12·	(8·)	8·?	—
fig. 12........	13·	(7·5)	9·	5·
fig. 13........	9·?	(6·?)	6·	3·5
fig. 14........	10·?	(6·5)	7·	—
Woodcut fig. 6........	12·6	(8·6)	8·3	5·3

Suboblong, rounded unequally at the ends (figs. 11 and 12), being lower in front than behind: ventral curvature of the right valve (woodcut, fig. 6) gentle and nearly uniform; of the left valve (figs. 12, 13, and 14) oblique: the straight hinge-line has two-thirds of the length of the valve; dorsal angles apparent, but not strongly developed. Surface smooth, with its convexity usually quite in the middle; eye-spot well marked and simple; the muscle-spot not visible. These specimens are mostly casts, only fig. 13 retaining some of the test; and on this there is an accidental mark simulating the muscle-spot.

In some respects this form approaches *Leperditia Balthica*; but the right valve is too nearly oblong,* and the left valve is too oblique on its lower margin, nor are the dorsal angles sufficiently pronounced.

The species is named in honour of J. F. Whiteaves, Esq., F.G.S., Palæontologist of the Geological Survey of Canada, whose kind courtesy has enabled me to examine this valuable series of Canadian Palæozoic Ostracoda.

Pl. xi, figs. 11 and 12 are among eight specimens in a hard cream-coloured limestone from Chemahawin, on the Saskatchewan River, north-west of Cedar Lake, and geologically a little above the beds at [illegible]. Collected by Mr. Tyrrell in 1890. One right valve has its ventral edge slightly swollen after the fashion of the specimen shown in fig. 12 [illegible].

Pl. xi, fig. 13, is from [illegible] Island, Cedar Lake, in a yellowish crystalline limestone of the same geological zone as the last mentioned specimens. Collected by Mr. Tyrrell in 1890.

18. LEPERDITIA [illegible], sp. nov.

Pl. xii, figs. 6, 7, and 9.

	Length.	Hinge-line.	Height.	
[illegible]	[illegible]	[illegible]	4	mm.
[illegible]	[illegible]	[illegible]	[illegible]	mm.

[illegible] straight at the back, and gently curved [illegible] semicircular in front, and with a [illegible] the hinder curve (fig. 7, ×4). Fig 9 [illegible] the specimen being [illegible] margin of the left valve (fig. 7) is turned sharply inwards, and bears minute pimples (casts of little pits) along the marginal angle. Surface not very convex, smooth and destitute of any visible ocular and muscular spots.

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* [illegible] dotted line; the wood-[illegible] representing the front extremity, which is much damaged [illegible] magnified three times to compare with these [illegible]

These casts are common (fig. 6) in hard, white, thin bedded limestone from the foot of the Grand Rapids below Old Portage, near the mouth of the Saskatchewan River. Together with them are many other *Leperditiæ*, such as pl. xii, figs. 8 and 15, and pl. xiii, fig. 2, see page 107. Fig. 9 is from a hard, rough, buff-coloured limestone, weathering grey, on the Saskatchewan River below (east of) Cedar Lake,* which is not far north of Lake Winnepegosis. Besides one *Isochilina grandis*, var. *latimarginata*, four specimens of this rock contain three *Leperditiæ* not well exposed. Pl. xii, fig. 9 is one of them; and there was a small left valve (not figured) with a sharply inturned ventral margin. Collected by Mr. Tyrrell. *L. Eichwaldi*, Schmidt (Mém. Acad. Imp. Sci. St. Pétersbourg, Ser. 7, vol. XXI, No. 2, 1873, p. 17; and vol. xxxi, No. 5, 1883, p. 11, pl. i, fig. 1), is one of the few *Leperditiæ* that present such a subquadrate outline as the foregoing.

19. LEPERDITIA SELWYNII, sp. nov.

Pl. 12, figs. 1-5.

	Length,	(hinge-line),'	height,	thickness	of surface.
Fig. 1........	11·	(7·)	7·5	4·	mm.
Fig. 2........	12·	(9·)	8·5	5·	mm.
Fig. 3........	10·	(6·5)	6·5	4·	mm.

Neatly Leperditian in shape; straight on the back, with definite dorsal angles; curved on the free margins, more fully behind than in front; surface smooth and of a brownish colour; traces of a muscle-spot observable in one broken and weathered large specimen. The specimens vary in size according to age; for the left valves, figs. 1 *a* and 2 *a*, differ in the obliquity of the ventral margin, and the smaller (younger) individual, fig. 3 *a*, which is the overlapping and therefore the relatively larger valve, is less oblique on the ventral margin than fig. *a*, and much less oblique than fig. 2 *a*; probably an older right valve would have a more oblique ventral curvature.

The subcentral convexity of these valves varies slightly. The ventral edge of both valves (figs. 1 *b* and 3 b is inturned; but the right overlapping valve (fig. 3 b) has a roundly overturned edge; and the left or overlapped valve has a sharply inturned flat edge (figs. 1 *b* and 4), against which the opposite edge rested when the carapace was closed. Compare figs. 1 *b*, 2 b, 4 *c*, and 7, in pl. vi, 'Ann. Mag. Nat. Hist.' ser. 2, vol. XVII, 1856. Inside the lip of the left valve is ornamented with delicate minute dentilures and striæ (fig. 5), as in other instances (see figs. 4 *b*, 5 *b*, of the same pl. vi, 1856).

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* "The rock outcropping on Cedar Lake was found to be the same as that on the northeast shore of Lake Winnipegosis. It was, however, here found to contain a much larger number of fossils, which clearly determine its age as about that of the Niagara formation of Iowa and Wisconsin. The rock through which the river has cut its gorge at the Grand Rapids also belongs to the same formation." Mr. Tyrrell, in the "Summary Report of the Geol. Surv. Department for 1890," p. 23.

These valves approach in outline those of *Leperditia Tyraica*, Schmidt, Mém. Acad. Imp. Sci. St. Pétersbourg, Ser. 7, vol. XXI, No. 2, p. 13, figs. 10 and 11: but they are less angular at the ends of the hinge, are without marginal ledges, and are quite smooth, without eye-spot. These specimens are from Jupiter River, Anticosti (collected by Prof. Macoun in 1883), on seven small slabs of compact grey limestone, probably composed of small organisms and fragments of larger forms: weathering light brown. They belong to the "Division No. 2" of Billings's "Anticosti Group," and are at about the horizon of the Clinton Formation of New York and Ontario.

This distinct species I propose to name after the eminent Director of the Geological Survey of Canada, A. R. C. Selwyn, C.M.G., F.R.S., &c., under whose auspices this memoir has been undertaken.

Besides this addition to the Silurian fauna of Anticosti, we must remember the six Beyrichian forms shown in plate xi, and the nine other Ostracoda described and figured in the Quart. Jour. Geol. Soc., vol. XLVI, 1890, pp. 545-550.

C. FROM THE DEVONIAN ROCKS.

Of the Devonian species here described some are from Thedford, Ontario, namely, the specimens represented by figs. 10–13 of pl. xi. Although already referred to in the Quart. Journ. Geol. Soc., these have not hitherto been sufficiently described and figured.

Of the others (the originals of figs. 14–16, pl. xi) were collected by Mr. McConnell on the Hay River, which runs into Great Slave Lake, and the rest by Mr. Tyrrell at two different localities on Lake Winnipegosis.

Primitiopsis punctulifera, figs. 10 and 11, is known only in the Hamilton group, but the genus is also known in the Upper Silurian of Europe.

Of the other genera, *Kirkbya* ranges from the Silurian to the Carboniferous. [illegible] is also Silurian. *Primitia* ranges from the Cambro-Silurian to the Carboniferous. *Aparchites*, *Isochilina*, *Elpe* and *Leperditia* are Cambro-Silurian and Silurian also.

1. APARCHITES MITIS, (sp. nov.).

Pl. 11, figs. 15 a & b.

Length 1· (hinge-line ·7), height ·55, thickness ·4 mm.

Elongate-subovate. straight on the back, rounded behind, gently curved on the ventral margin, obliquely curved at the antero-ventral region, but with a fuller curve than the same edge has in *Primitia concinna* *, Jones (Ann. Mag. Nat. Hist., ser. 3, vol. I, 1858, p. 249, pl. x, figs. 3, 4, and vol. XVI, 1865, p. 424, and Geol. Surv. Canada, Org. Rem., Dec. III, 1858, p. 99). The convexity also differs from the neatly elliptical outline of the latter, and seems to be fuller at the anterior moiety.

The specimen before us having no trace of a sulcus or of a central pit, nor of any overlap, must be taken as an *Aparchites*, and may be distinguished as A. MITIS, sp. nov.

Attached to a *Spirifera disjuncta* from the Devonian Rocks of Hay River (Great Slave Lake), at about 40 miles above its mouth, collected by Mr. R. G. McConnell in 1887.

This species, or one extremely like it, occurs in a grey, compact, Devonian limestone from the Athabasca River. Collected by Mr. McConnell in 1890.

2. PRIMITIA SCITULA, (sp. nov.).

Pl. 11, figs. 14 a, 14 b.

Length ·77 (hinge-line ·5), height ·5, thickness ·4 mm.

This is a small *Primitia*, suboblong (short oblong with rounded ends) straight on the dorsal, gently curved on the ventral edge; anterior extremity symmetrically rounded, and bordered with a flattened rim, Postero-dorsal angle sufficiently pronounced to interfere with the symmetry of the hinder curve. Surface more convex behind than before, bearing a central pit, and marked with a coarse and shallow punctation.

Primitia trigonalis, J. & H., Ann. Mag. Nat. Hist., ser. 3, vol. XVI; 1865, p. 421, pl. viii, fig. 4, from the Wenlock Limestone of Shropshire exhibits some of the features seen in the form under notice, and *P. sigillata*, J. *op. cit.*, vol. I, 1858, p. 242, pl. ix, fig. 5, and vol. VI, 1865,

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* In the Quart. Journ. Geol. Soc., vol. XLVI, 1890, pp. 7-9, I have shown that this is probably the same as d'Eichwald's *Leperditia minuta*, and possibly equivalent to some of the specimens grouped under Dr. James Hall's *Leperditia* (*Isochilina*) *cylindrica*.

p. 418, from the Wenlock Limestone of Beechey Island, is still more like it, but has the normal sulcus instead of the central pit, and has not so definite a marginal lip.

The trivial name SCITULA will suit this pretty little *Primitia*. One individual is attached to a specimen of *Strophodonta demissa*, and one to an *Orthis*, from the Devonian rocks of the Hay River (which runs into Great Slave Lake), at about 40 miles above its mouth collected by Mr. R. G. McConnell in 1887.

3. ISOCHILINA BELLULA, (sp. nov.).

Pl. 11, figs. 16 a, 16 b.

Length 1·0 (hinge-line ·65), height ·6, thickness ·4 mm.

Suboblong, upper and lower edges nearly straight, ends rounded, front margin neatly curved, the hinder margin sloping down from the back with an oblique curve. Surface smooth, with a mid-dorsal subtriangular depression; the greatest convexity at the posterior third; marginal lip at the free edges.

This is evidently allied to *Isochilina lineata*, Jones (Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 21, pl. ii, figs. 5 and 8), from the Hamilton group at Monteith Point, Canandaigua, State of New York.

This *neat* little form may well deserve the name ISOCHILINA BELLULA as a new species.

One specimen was found attached to a *Strophodonta demissa* and another to *Atrypa reticularis*; both were collected by Mr. R. G. McConnell in 1887, from the Devonian rocks of the Hay River, Great Slave Lake, at about 40 miles above its mouth.

4. ISOCHILINA DAWSONI, (sp. nov.)

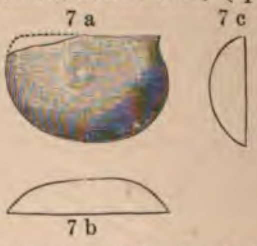

Fig. 7. *Isochilina Dawsoni*, sp. nov., *a*, left valve, cast; *b*, edge view; *c*, end view. Magnified 15 diameters.

Size: Length 1·5 (hinge-line 1·3); height 1·0; thicknes of carapace ·66 mm.

Five specimens of a white polyzoan limestone, of Devonian age, were collected by J. B. Tyrrell in 1889 from a small island on the south-east side of Dawson Bay, Lake Winnipegosis. In this limestone, which is made up of organic remains, there are a few minute internal casts of Ostracoda; but only two are distinct enough for figuring and description.

One of these small white casts (woodcut, fig. 7) is that of a left valve, leperditioid in shape, suboblong, not so fully rounded in front as behind; hinge line long; front dorsal margin obscured by matrix; hinder angle sharp, with curve below it. Subconvex, with the greatest fullness rather above the median line and in the posterior moiety of the value. A very faint, circular, subcentral depression is just traceable.

This may be a true *Isochilina*, and I wish to associate with it the name of the talented and enthusiastic Geological Surveyor, Dr. G. M. Dawson, after whose father the Bay itself was named.

5. ELPE TYRRELLII, (sp. nov.).

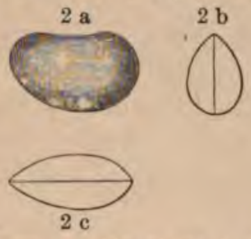

Fig. 8. *Elpe Tyrrellii*, sp. nov. *a*, side view; *b*, edge view; *c*, end view. Magnified 15 diameters.

Size: Length 1·13 (hinge-line ·66); height ·76; thickness ·46 mm.

This is a white cast of a small carapace, subreniform, obliquely rounded and narrow in front, full with a semicircular curve behind; ventral margin boldly curved; dorsal margin somewhat depressed and hollow in the middle. Surface convex, and most so below the median line and in the posterior moiety.

This is much like Meek's *Cythere Cincinnatiensis* (Proceed. Acad. Nat. Sci., 1872, p. 331, and Geo. Surv. Ohio, Paleont., vol. I, 1873, p. 158, pl. xiv, figs. 1 *a-d*); but is contracted at the anterior moiety. The Ohio form is variable and may be represented by more than one species (Meek). It is, however, much more like some drawings of the same species, kindly sent to me in 1888 by Mr. E. O. Ulrich of Newport, Ky. The proportions are only slightly different, a Cincinnati specimen having—Length 1· (hinge-line ·72); height ·66;

thickness ·55; but the greatest convexity in this latter form is above (not below) the median line; and the concavity of the dorsal line is more pronounced, the valve being swollen on each side at the ends of the hinge-line, but more so behind than in front.

Mr. Ulrich informed me, in 1888, that he had met with more than one species of this kidney-shaped form in the Cincinnati beds, with a smooth surface and slight ventral overlap, and that in his MS. of 1881, unfortunately destroyed by accident, he had separated them as a distinct genus under the name *Leioditia*; and there is no doubt that we have here a specimen of the same kind, though slightly different, and from a much later horizon. After further research, Mr. Ulrich suggested, by letter, in 1890, that *Cythere Cincinnatiensis*, Meek, a variety of the same, *C. irregularis*, Miller, and *Leperditia radiata*, Ulrich, might probably be grouped under Barrande's genus *Elpe*, having much in common with each other and with it, except that he found *C. Cincinnatiensis* and *L. radiata* to have a subcentral pit and a radiate structure of shell, which features, however, are of course, wanting in casts. Although Barrande's *Elpe pinguis** is more globose, and much larger than these American specimens, yet it is quite feasible to suppose that they may belong to the same genus; the above mentioned forms presenting the necessary gradations.

Taking *Elpe*, then, as being probably the genus to which this little fossil from Dawson Bay, Lake Winnipegosis, belongs, I propose to call it *E. Tyrrellii* after the energetic member of the Canadian Geological Survey who collected it.

6. LEPERDITIA (?) EXIGUA, (nov).

Pl. 12, fig. 10.

Length ·74 (hinge-line ·56), height ·48 mm.

Small, subovate or ovate-oblong; rounded at the ends, but smaller in front than behind; straight on the back, dorsal angles blunt; smooth and convex. This little left valve has somewhat the same outline as the much larger right valve of *L. Selwynii*, fig. 3 a; but it is relatively fuller behind, and has no frontal slope. It may also be compared with fig. 13 a, and even with pl. xiii, fig. 11 a; but, though it looks like a *Leperditia*, its small size and poor state of preservation

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A unique cast, from M. Barrande's stratum f. 2 of the stage F, of his Fauna III (Upper Silurian) near Mnienian, Bohemia. "Syst. Silur. Bohème," vol. I, Supplem. 1872, p. 510, pl. xxvi, fig. 15.

hinder a definite determination of its generic place. It has a faint resemblance in shape to a large Carboniferous *Leperditia* of Belgium.

In a whitish limestone of Devonian age, with other small obscure organisms, from a small island (Island Z.) on the east side of Lake Winnipegosis, about thirty miles south of Long Point. Collected by Mr. Tyrrell in 1889.

7. ULRICHIA CONRADI, Jones.

Pl. 11, fig. 13.

Ulrichia Conradi, Jones. Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 544, woodcut, fig. 2.

Length ·8 (hinge-line ·65), height ·45 mm.

A small, left valve, suboblong, straight on the back, obliquely curved below, rounded at the ends, the posterior higher and fuller than the anterior. Two largish prominent knobs, oval in section and obliquely peaked, divide the dorsal region into three nearly equal portions; the front tubercle is smaller than the other. The surface of the valve is faintly reticulated, and has along the free borders a neat marginal ridge.

This small bituberculate and punctate valve is near *P. Morgani*, Jones, Q. J. G. S., vol. XLVI, p. 5, pl. iv, fig. 5; but it is more oblong, margined with a distinct raised rim, and has the two tubercles (which take the place of the sulcus of *Primitia*) obliquely peaked. This species was named in memory of T. A. Conrad, who was one of the first to describe the fossil Ostracoda of North America.

From the Hamilton Formation at Thedford (formerly Widder), Ontario, Canada. Collected by Dr. G. J. Hinde, F.G.S.

8. PRIMITIOPSIS PUNCTULIFERA (Hall).

Pl. 11, figs. 10, 11 a, 11 b.

Leperditia punctulifera, Hall. Thirteenth Report of the Regents of the University of New York, 1860, p. 92.
Primitiopsis punctulifera, Jones. Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 9, pl. ii, figs. 7, 12, 13.

The occurrence at Thedford, Ontario, of numerous specimens of *Primitiopsis punctulifera* (Hall) in various stages of development as to size, reticulation, tubercles, and smoothness of ends (nothing of the last in the very young state; length ·9, height ·5 mm.), is mentioned at page 28 of the February number of the Quart. Journ. Geol. Soc., 1890.

Some interiors of small valves of *Primitiopsis punctulifera* are shown on one of the pieces of grey limestone (composed of small brachiopods, &c.) from the same place. They are 1·25 mm. long, and ·75 mm. high, and not full grown, but rather larger than fig. 7, pl. ii, Q. J. G. S., February, 1890. They show distinctly that the front border is bevelled inwards, the ventral edge of the right valve is somewhat inturned at its hinder moiety, the posterior edge is thin, and the dorsal edge straight, with a simple groove along its length, slightly overlapped by the outside edge of the valve brought over at the middle.

From the Hamilton group, at Thedford, Ontario. Collected by Dr. G. J. Hinde, F.G.S.

9. Kirkbya (?) Walcotti, Jones.

Pl. 11, figs. 12 a, 12 b.

Primitia (?) *Walcotti*, Jones. Quart. Journ. Geol. Soc., vol. XLVI, p. 543, woodcut, fig. 1.

Length ·95 (imperfect), height ·47 mm.

This imperfect, but very interesting specimen, is far more nearly related to some forms of *Kirkbya*, such as *K. costata* (McCoy), Ann. Mag. Nat. Hist., ser. 5, vol. XV, 1885, pl. iii, fig: 13, than to *Primitia*, to which genus it was at first referred with doubt. Gradations from the ribs of *K. costata*, as shown by *K. Scotica*, figs. 16 and 17, of the same plate [*], lead towards such obliquely anastomosing, close set, and tortuous riblets or wrinkles as seen in the specimen under notice.

This is, unfortunately, broken at one end and partly buried along the edges. It has a central pit, and is elegantly ornamented with narrow curved ridges and furrows (of about equal width). These are nearly straight, and somewhat inosculating on the dorsal, tortuous and interrupted on the ventral region. Small pits occur here and there along the furrows, as if marking obsolete meshes.

This was named as a species in honour of C. D. Walcott, F.G.S., of Washington, U.S., who has discovered and described several very interesting forms of North American Ostracoda.

From the Hamilton group at Thedford, Ontario. Collected by Dr. G. J. Hinde, F.G.S.

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[*] It may be mentioned that *K. costata* and its allies on the same plate tend towards *Entomis*, while *K. rigida* and *K. Urei* (figs. 18 and 19) lead to *Strepula*.

APPENDIX.

NOTES ON THE SPECIES OF OSTRACODA DESCRIBED AND FIGURED IN DECADE III, OF THE GEOLOGICAL SURVEY OF CANADA, PUBLISHED IN 1858.

Since the date of this publication a better knowledge of these and their allied forms has been obtained; and, their grouping and relationship being better understood, changes in their nomenclature have taken place.

1. *Beyrichia Logani*, p. 91, pl. xi, figs. 1–5.

This (with its varieties *reniformis*, fig. 1, and *leperditioides*, fig. 5, was referred to the genus PRIMITIA in the 'Ann. Mag. Nat. Hist.,' ser. 3, vol. XVI, 1865, pp. 416, 417, by Jones and Holl, on account of its simple sulcus or pit and the absence of Beyrichian lobes.

2. *Leperditia Canadensis*, var *nana*, p. 92, pl. xi, figs. 6, 7, 9, 10.

This is the typical *L. canadensis*. At first some *Leperditiæ*, allied to Conrad's *L. fabulites*, were grouped with the foregoing, and in the preparation of the memoir in Decade III, the relatively small size of the latter gave rise to the varietal term *nana*, which is not really required. Fig. 7 may be regarded as a smooth and rather elongate variety.

3. *Leperditia Canadensis*, var. *labrosa*, p. 93, pl. xi, fig. 8.

This was originally proposed as a variety in the "Ann. Mag. Nat. Hist.," ser. 3, vol. I, 1858, p. 245, where there is no mention of "*nana*." It may well be specifically distinct.

This small *Leperditia* has an oblong shape and a definite lip or flat margin at each extremity.

As formerly indicated, this form, now regarded as a species, is more nearly allied to *L. Canadensis* than to *L. fabulites*.

Note.—*Leperditia Josephiana*, *Louckiana*, and *labrosa* are known from the Trenton Limestone of Canada. *L. Josephiana*, also from the Trenton Limestone of Tennessee, and *L. labrosa* from the Black-river Limestone of Canada.

4. *Leperditia Canadensis*, var. *Louckiana*, p. 93, pl. xi, fig. 11.

Leperditia Canadensis (?), Jones. Ann. Mag. Nat. Hist., ser. 3, vol. I, 1858, p. 245, pl. ix, fig. 16 (afterwards var. *Louckiana*).

Leperditia Canadensis, var. *Louckiana*, Jones. Geol. Surv. Canada, Org. Rem., Decade III, 1858, p. 93, pl. xi, fig. 11.

Leperditia fabulites (Conrad), var. *Louckiana*, Jones. Ann. Mag. Nat. Hist., ser. 5, vol. VIII, 1881, p. 343.

Leperditia Louckiana, Jones. *Op. cit.*, vol. XIV, 1884, p. 340.

5. *Leperditia Canadensis*, var. *Pauquettiana*, p. 94, pl. xi, fig. 12.

6. " " " *Josephiana*, p. 94, pl. xi, fig. 16.

Cytherina fabulites, Conrad. Proc. Ac. Nat. Sc., Philadel. 1843, vol. I, p. 332.

Leperditia fabulites, Jones. Ann. Mag. Nat. Hist., ser. 2, vol. XVII, 1856, p. 897, ser. 2, vol. I, p. 146; ser. 5, vol. VIII, 1881, pp. 342-4.

Leperditia Canadensis, var. *Josephiana*, Jones. . Ann. Mag. Nat. Hist., ser. 3, vol. I, 1858, p. 341; Geol. Surv. Canada, Dec. III, 1858, p. 94, pl. xi, fig. 16.

Leperditia fabulites (Conrad), var. *Josephiana*, Jones. Ann. Mag. Nat. Hist., ser. 5, vol. VIII, 1881, p. 344, pl. xix, fig. 7, pl. 20, figs. 7 and 8, and p. 345, pl. xx fig, 4 ?.

Leperditia fabulites, Whitfield. Report Geol. Surv. Wisconsin, vol. I, 1883, p. 160, fig. *f*.

Leperditia Josephiana, Jones. Ann. Mag. Nat. Hist., ser. 5, vol. XIV, 1884, p. 341.

7. *Leperditia Canadensis*, var. *Anticostiana* [*Anticostiensis**], p. 95, pl. xi, fig. 17.

In the 'Ann. and Mag. Nat. Hist.' ser. 5, vol. VIII, 1881, pp. 343, 344, these had been referred to *Leperditia fabulites* (Conrad); and, although *Josephiana* was separated from *fabulites*, *op. cit.*, vol. XIV, 1884, pp. 341, 342, yet it is probably best either to keep it as a variety of *fabulites*, as stated *op. cit.*, 1881, p. 344, or, better still, as the same as *L. fabulites* itself. *L. Louckiana* and *L. Anticostiensis* are treated as "species," *op. cit.*, 1884, pp. 340–342.

The several Canadian *Leperditiæ* were grouped by me in Ann. and Mag. Nat. Hist., November, 1881, p. 343, in three sets, namely, 1. *Lep. Canadensis*, Jones, with its var. *nana* and var. *labrosa*. 2. *Lep. fabulites* (Conrad), with varieties *Josephiana*, *Anticostiana* (more properly *Anticostiensis*), *Louckiana*, and *Pauquettiana*. 3. With *Lep. amygdalina*, Jones, as a separate type. In 1884 I thought it advisable to treat the varieties as "species."

Some elegant specimens in the Museum of the McGill University, Montreal, which had been collected from the Trenton Limestone of Murray Bay, Canada, were the basis of my note on *L. Josephiana* in the Ann. Mag. Nat. Hist., November, 1884, p. 341. Like the previously figured specimens, these vary somewhat among themselves and from others, especially as to the outline of the front end, which is often obliquely truncate for a short distance below the dorsal angle. Some have a slight lip at one extremity of the valve and some have it at the other.

8. *Leperditia Anna*, p. 96, pl. xi, fig. 13.

This retains its status.

9. *Leperditia amygdalina*, p. 96, pl. xi. figs. 18, 19.

This also holds good. See 'Ann. and Mag. Nat. Hist.,' Novemb, 1881, pp. 343, 344.

---

* Being named after a *place* and not after a *person*.

ISOCHILINA. p. 97. This is now regarded as a distinct genus, and not as a subgenus of *Leperditia.*

10. *Leperditia* (*Isochilina*) *Ottawa,* p. 97, pl. xi, fig. 14.
11. *Leperditia* (*Isochilina*) *gracilis,* p. 98, pl. xi, fig. 15.

These are true *Isochilinæ.*

CYTHEROPSIS, p. 98. This is not now applied as a generic term to any fossil Ostracoda.

12. *Cytheropsis concinna,* p. 99 ('A. M. N. H.,' April, 1858, p. 254, pl. x, figs. 3 and 4).

Being quite smooth and furrowless, it is an *Aparchites;* but, if it showed any sign of a dorsal sulcus or central pit it would come under *Primitia,* and probably be equivalent to *Primitia minuta* (Eichwald). See Quart. Journ. Geol. Soc., vol. XLVI, 1890, p. 7.

13. *Cytheropsis siliqua,* p. 99 (*op. cit.,* p. 249, pl. x, fig. 6).

This is probably a *Macrocypris* figured in a reversed position.

14. *Cytheropsis ? rugosa,* p. 100 (*op. cit.,* p. 249, pl. x, fig. 5).

This pretty little carapace was almost certainly figured in a reversed position. Its generic position has not been determined. It may possibly belong to *Cytherella.*

GENERIC AND SPECIFIC NAMES NOW ADOPTED.

1. *Primitia Logani,* Jones, pl. xi, figs, 1-5; var. *reniformis,* fig. 1, and var. *leperditioides,* fig. 5.
2. *Leperditia Canadensis,* Jones, figs. 6, 7, 9, 10.
3. " *labrosa,* Jones, fig. 8.
4. *Leperditia Louckiana,* Jones, fig. 11.
5. *Leperditia Pauquettiana,* Jones, fig. 12.
6. *Leperditia fabulites* (Conrad), fig. 16 (including *Josephiana*).
7. *Leperditia Anticostiensis,* Jones, fig. 17.
8. *Leperditia Anna,* Jones, fig. 13.
9. *Leperditia amygdalina,* Jones, figs. 18, 19.
10. *Isochilina Ottawa,* Jones, fig. 14.
11. *Isochilina gracilis,* Jones, fig. 15.
12. *Aparchites concinnus,* Jones, page 99.
13. *Macrocypris ? siliqua,* Jones, page 99.
14. *Cytherella ? rugosa,* Jones, page 100.

PLATE X.

Figure 1. *Isochilina grandis*, Jones, var. *latimarginata*, nov. a, right valve; b. ventral view; c, end view. Nat. size.

“ 2. The same. a, right valve; b, ventral view; c, end view. Nat. size.

“ 3. The same. Muscle-spot. Magn. twice.

“ 4. The same. Muscle-spot of another individual. Magn. three times,

“ 5. *Leperditia Hisingeri*, Schmidt, var. *fabulina*, nov. a, left valve; b. ventral edge; c, end view. Magn. twice.

“ 6 *Leperditia marginata*, Schmidt. a, right valve; b, ventral edge; c, end view. Magn. twice.

“ 7 *Leperditia Hisingeri*, Schmidt, var. *fabulina*, nov. Two valves of a small individual, more or less imbedded. Magn. twice, Figs. 1-7 from Long Point, Lake Winnepegosis.

“ 8 *Primitia mundula*, Jones, var. *effossa*, nov. Right valve. Magn. 15 diam. Quebec City.

“ 9 *Primitia mundula*, Jones, var. *incisa*, nov. a, right valve; b, ventral edge; c, end view. Magn. 15 diam. Lorette Falls.

“ 10 *Isochilina Ottawa*, Jones, var. *intermedia*, nov. a, left valve; b, ventral view. Magn. 5 diam. Aylmer, Prov. Quebec.

“ 11 The same, var. *intermedia*. a, right valve; Magn. 5 diam.; b, portion of marginal rim; Magn. 25 diam.

“ 12 *Aparchites mundulus*, sp. nov. Right valve. Magn. 15 diam. [The dorsal line is made too long in the figure.] Lorette Falls.

“ 13. *Isochilina Whiteavesii*, sp. nov. a, left valve [the ventral margin is brought down too low in the figure]; b, ventral edge. Magn. 10 diam. Lorette Falls.

“ 14. *Isochilina Amii*, sp. nov. a, left valve; b, ventral view. Magn. 10 diam. Lorette Falls.

“ 15. *Leperditia ? obscura*, sp. nov. a, carapace left valve shown; b, ventral view of carapace, (the right valve represented only by its internal cast). Magn. 7 diam. Lorette Falls.

“ 16. *Isochilina labellosa*, sp. nov. a, right valve; b, ventral view. Magn. 15 diam. Aylmer, Prov. Quebec.

“ 17. The same. Left valve. Magn. 7 diam., Aylmer, Prov. Quebec.

“ 18. *Leperditia balthica* (Hisinger), var *primæva*, nov. Right valve. Magn. 7 diam. Carleton Co., Ontario.

“ 19. *Isochilina labellosa*, sp. nov. Ventral view. Magn. 7 diam. Aylmer, Prov. Quebec.

PLATE X

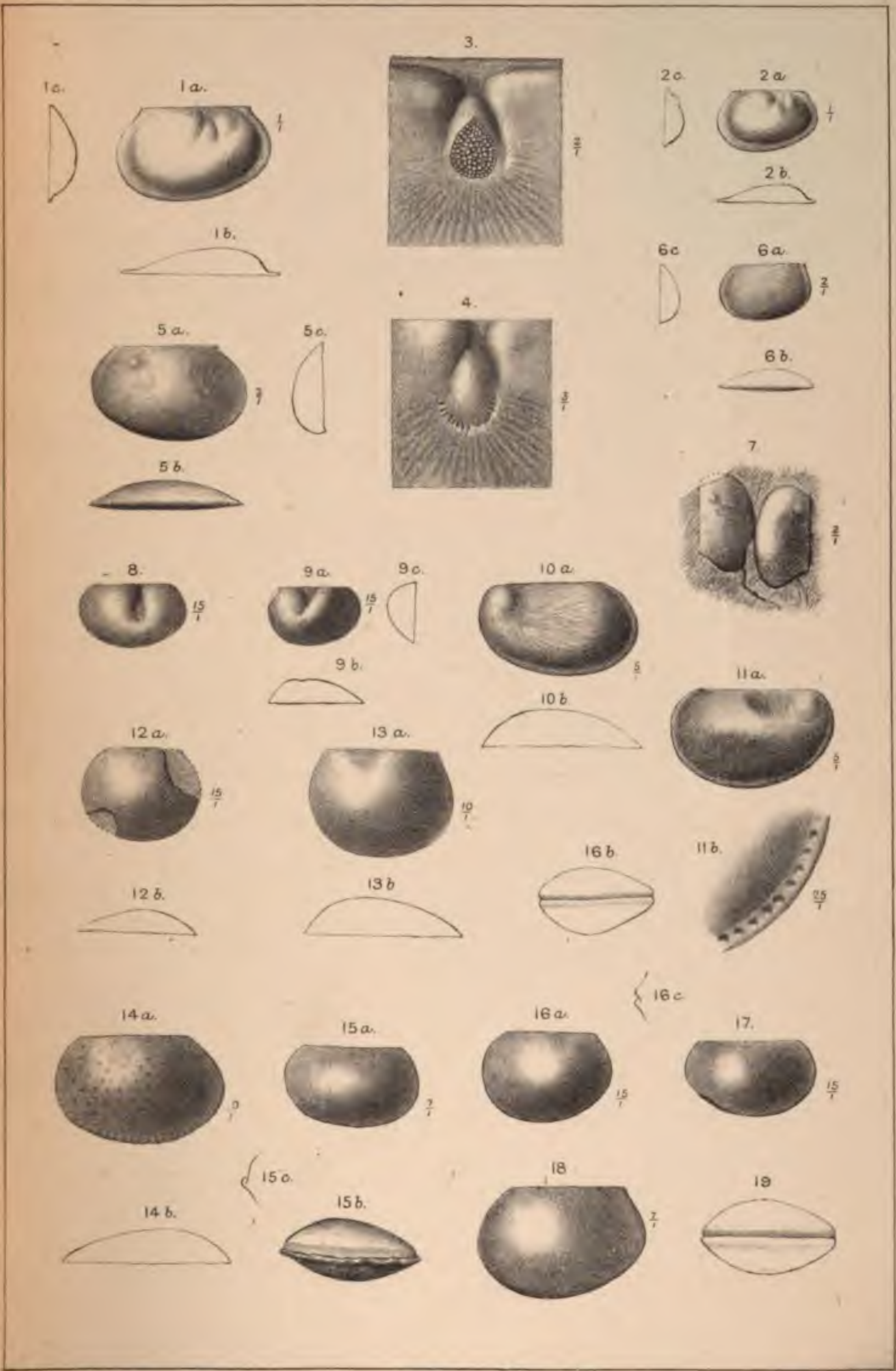

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PLATE XI.

Figure 1. *Beyrichia tuberculata* (Kloeden), var. *strictispiralis*, nov. Right valve (cast). Magn. 7 diam. Arisaig, N. S.

" 2. The same, var. *pustulosa*, Hall. Right valve (cast). Magn. 7 diam. Arisaig.

" 3. The same. Type. Right valve (cast). Magn. 7 diam. Arisaig.

" 4. The same, var. *Noetlingi*, Reuter. a, right valve (cast); b, ventral aspect. Magn. 7 diam. Arisaig.

" 5. The same, var. *Noetlingi*, Reuter. Right valve (cast). Magn. 7 diam. Arisaig.

" 6. *Beyrichia æquilatera*, Hall. Left valve (cast). Magn. 7 diam. Arisaig.

" 7. *Beyrichia clavigera*, sp. nov. Left valve. Magn. 7 diam. Aylmer, Quebec.

" 8. The same, var *clarifracta*, nov. Right valve. Magn. 7 diam. Aylmer, Quebec.

" 9. *Beyrichia quadrifida*, sp. nov. a, left valve; b, ventral aspect. Magn. 15 diam. Lorette Falls.

" 10. *Primitiopsis punctulifera* (Hall). Young individual. Right valve. Magn. 30 diam. Thedford.

" 11. The same. Young individual. a, inside of left valve; Magn. 20 diam.; b, the inner aspect of the dorsal edge; Magn. 40 diam. Thedford, Ont.

" 12. *Kirkbya ? Walcotti*, Jones. a, partly imbedded valve; Magn. 30 diam.; b, portion; Magn. 60 diam. Thedford.

" 13. *Ulrichia Conradi*, Jones. Left valve. Magn. 30 diam. Thedford.

" 14. *Primitia scitula*, sp. nov. a, right valve; b, ventral view. Magn. 20 diam. Hay River.

" 15. *Aparchites mitis*, sp. nov. a, left valve; b, ventral view. Magn. 30 diam. Hay River.

" 16. *Isochilina bellula*, sp. nov. a, left valve; b, ventral view. Magn. 30 diam. Hay River.

PLATE XI.

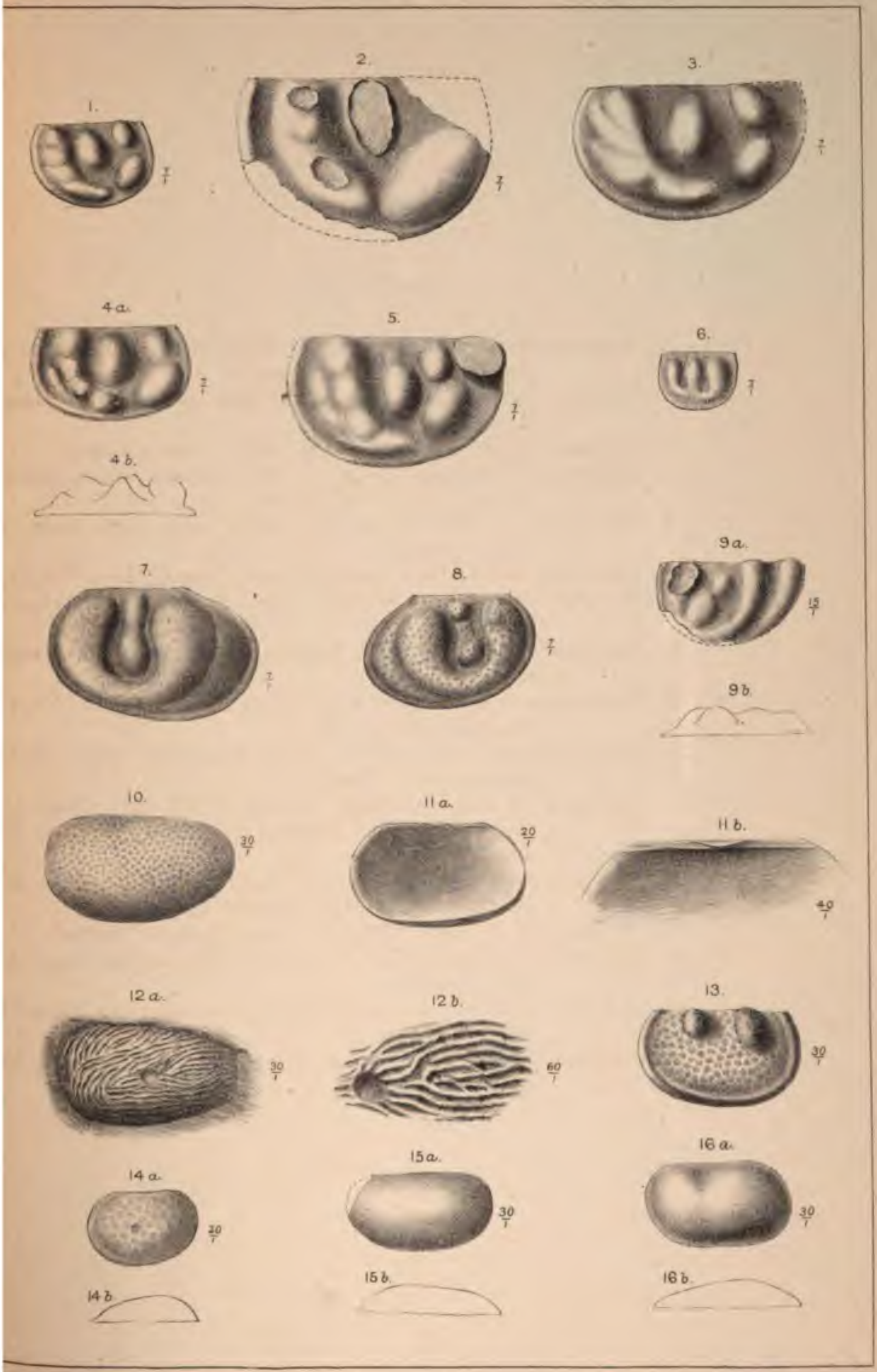

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PLATE XII.

Figure 1. *Leperditia Selwynii*, sp. nov. a, left valve; b, ventral edge.

" 2. The same. a, left valve; b, edge view; c, end view.

" 3. The same. a, right valve; b, ventral edge; end view.

" 4. The same. Ventral edge, partly exposed, of a left valve.

" 5. The same. Interior of the united ventral edges. Figs. 1–5 from Anticosti. Magn. 2 diam.

" 6. Portion of slab with casts and moulds of *Leperditiæ* from the Grand Rapids, Saskatchewan River. Magn 2 diam.

" 7. *Leperditia cæca*, nov. Magn. 4 diam. Grand Rapids.

" 8. ——— *Hisingeri*, Schmidt, var. *egena*, nov. a, right valve; b, ventral edge; c. end view. Magn. 4 diam. Grand Rapids.

" 9. ——— *cæca*, nov. Left valve. Magn. 2 diam. Below Cedar Lake.

" 10. ——— *exigua*. Left valve. Magn. 25 diam. Island on east side of Lake Winnipegosis.

" 11. ——— *Whiteavesii*, nov. Right valve.

" 12. ——— ——— a, left valve; b, ventral edge; c, end view. Figs. 11 and 12. Magn. 2 diam. Chemahawin, Saskatchewan River.

" 13. ——— ——— a, left valve retaining its shell, but broken behind and damaged at the centre; b, ventral aspect; c, end view. Magn. 2 diams. From Old Fort Island, Cedar Lake.

" 14. ——— ——— Left valve. Magn. 2 diam. Chemahawin.

" 15. ——— *Hisingeri*, Schmidt, var. *fabulina*, nov. a, right valve; b, ventral edge; c, end view. Magn. 3 diam. Foot of the Grand Rapids, Saskatchewan River.

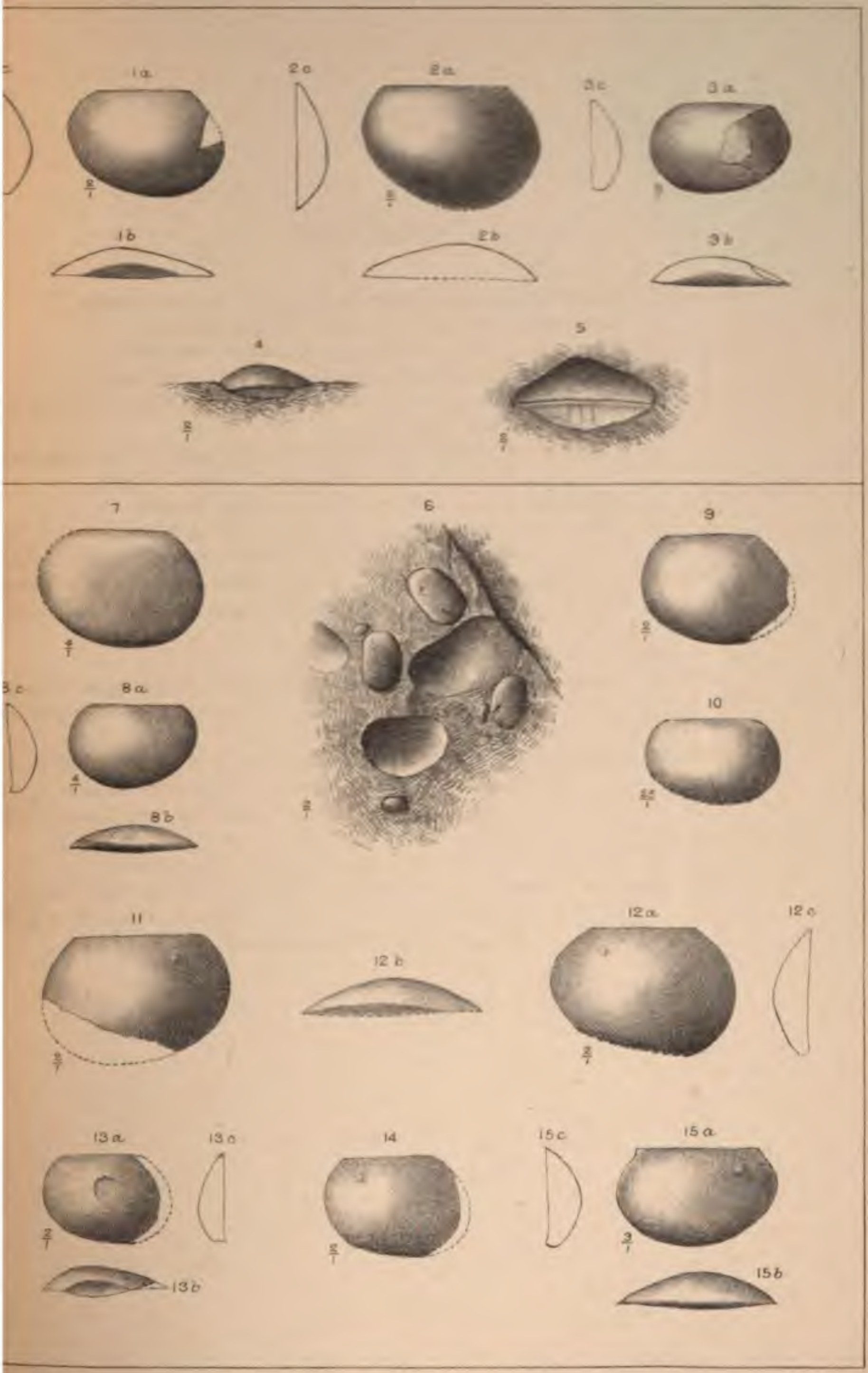

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PLATE XIII.

Figure 1. *Leperditia Hisingeri*, Schmidt. a, left valve; b, ventral edge; c, end view. Magn. 3 diam. Long Point, Lake Winnipegosis.

" 2. —— —— var. *fabulina*, nov. Left valve. Magn. 3 diam. Foot of the Grand Rapids.

" 3. —— —— —— a, right valve; b, ventral edge; c, end view. Magn. 3 diam. Long Point, Lake Winnipegosis.

" 4. —— —— var. *gibbera*, nov. Left valve. Magn. 3 diam. Long Point, Lake Winnepegosis.

" 5. —— —— var. *fabulina*, nov. Left valve. Magn. 3 diam. Long Point, Lake Winnepegosis.

" 6. —— —— —— Ventral edge of a left valve. Magn. 3 diam Long Point, Lake Winnepegosis.

" 7. *Leperditia phaseolus* (Hisinger). a, right valve; b, edge view; c, end view.

" 8. —— —— Right valve. Magn. 3 diam. Roche Rouge, Saskatchewan River.

" 9. —— *Hisingeri*, Schmidt. a, left valve; Magn. 2 diam.; b, portion of postero-dorsal region. Magn. 25 diam. Long Point.

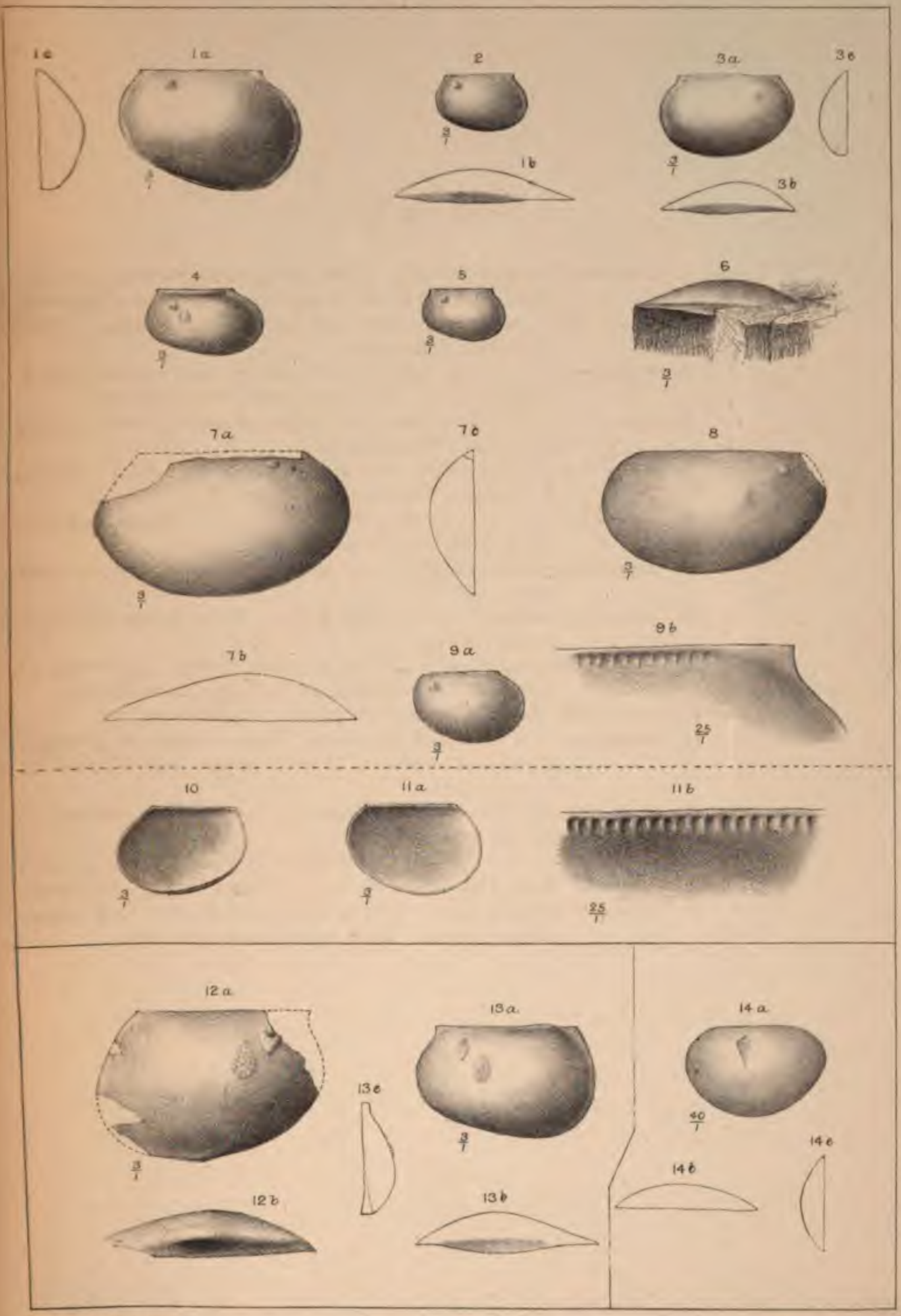
" 10. —— *alta*, Hall. Interior of left valve. Magn. 3 diam.

" 11. —— —— a, interior of right valve; Magn. 3 diam.; b, portion of inside of hinge-line. Magn. 25 diam. Figs. 10 and 11 from Schoharie.

" 12. —— *balthica* (Hisinger), var. *Guelphica*, nov. a, right valve; b, ventral edge.

" 13. —— —— —— —— a, left valve; b, ventral edge; c, end view. Figs. 12 and 13. Magn. 3 diam. Durham, Ontario.

" 14. *Aparchites Tyrrellii*, nov. a, right valve; b, edge view; c, end view. Magn. 40 diam. Black Island, Lake Winnipeg.



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GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

CONTRIBUTIONS
TO
CANADIAN
MICRO-PALÆONTOLOGY.

PART IV.

Radiolaria

BY

1326 No.

DR. D. RÜST,
(HANOVER, GERMANY.)

WITH INTRODUCTION BY J. B. TYRRELL.

OTTAWA:
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S
MOST EXCELLENT MAJESTY.
1892.

Price ten cents.

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NOTE.

The present Report, which constitutes Part IV. of "Contributions to Canadian Micro-Palæontology," was kindly and gratuitously prepared for the Canadian Geological Survey by Dr. D. Rüst, of Hanover, Germany, who has made a life study of fossil Radiolaria.

It consists of descriptions and illustrations of thirteen new and three previously known species of Radiolaria, collected by officers of this Department from the upper Cretaceous rocks of North-Western Manitoba.

To this has been prefixed a short introduction by Mr. Tyrrell, Geologist in charge of the explorations in Manitoba, on the stratigraphical position of the bed from which the fossils were collected.

The pagination of the report, and the numbering of the plates have been made consecutive with those of Parts I., II. and III., by A. H. Foord, E. O. Ulrich and T. Rupert Jones, respectively.

ALFRED R. C. SELWYN,

Director, Geological Survey.

OTTAWA, January, 1892.

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8. Tricolocapsa salva, *Rüst.*
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CONTRIBUTIONS TO CANADIAN MICRO-PALÆONTOLOGY.

PART IV.

By Dr. D. Rüst,
(Hanover, Germany.)

6.—*Radiolaria from the Pierre Formation of North-Western Manitoba.*

INTRODUCTION.

The central portion of the Province of Manitoba is a moderately even plain, at a mean elevation of about 800 feet above the sea, underlain by undisturbed flat-lying limestones and shales, ranging in age from Cambro-Silurian up to Devonian.

On its eastern side this plain is bounded by the high and often steep escarpment of the eastern face of the Second Prairie Steppe, rising from eight to nineteen hundred feet above the level of the country to the east, and ascending from the former elevation in the vicinity of the International Boundary Line to the latter in the Duck Mountain, two hundred miles further north.

This escarpment, beneath its capping of glacial deposits, is composed exclusively of the eroded edges of horizontal, undisturbed and conformable Cretaceous rocks ranging in age upwards from the Dakotah sandstone, about the top of the Middle Cretaceous, to high up in the Pierre shales, towards the top of the Upper Cretaceous. The total thickness of Cretaceous beds seen in the district is approximately 1,400 feet, and, with the exception of the soft Dakotah sandstone at the base of the section, consists entirely of argillaceous shales which vary to some extent in character in different portions of the series.

In the Benton formation, which immediately and conformably overlies the Dakotah sandstone, these shales consist largely of soft dark highly bituminous clays, without much admixture of calcareous material, and also, in Manitoba, with few distinguishable traces of fossils.

The Benton is overlain by a varying thickness of calcareous shales and chalk-marls with phosphatic bands, known as the Niobrara formation. The shales of this terrane are characterized by the presence of a large number of foraminifera, among which *Globigerina cretacea*, d'Orb., and *Textularia globulosa*, Ehr., are particularly abundant, but the following have also been identified for us by C. Davies Sherborn, Esq., F.G.S., of London, England, viz.:—*Globigerina bulloides*, *Globigerina linnæana*, *Cristellaria rotulata*, *Planorbulina ammonoides*, *Anomalina rotula*, *Bulimina variabilis*, *Verneuilina triquetra*, *Marginulina variabilis* and *Dentalina pauperata*. With these have also been found the succeeding species of invertebrate and vertebrate fossils, viz.:—*Serpula semicoalita*, *Ostrea congesta*, *Anomia obliqua*, *Inoceramus problematicus* fragments of this shell in great abundance, *Belemnitella Manitobensis*, *Loricula Canadensis*, *Ptychodus parvulus*, *Lamna Manitobensis*, *Enchodus Shumardi* and *Cladocyclus occidentalis*.

Overlying these calcareous deposits of Niobrara age is a thickness of 800 to 1,000 feet of non-calcareous dark or light grey clay shales belonging to the Pierre formation, which contain in their more southern and western extension a large number of beautifully preserved molluscan and other remains, but in the more northern portions of Manitoba, wherever they have been recognized, no large fossils could be found in them, and till the discovery of Radiolaria near the base of the formation, and therefore stratigraphically not far above the zone of the fossils just enumerated from the Niobrara rocks, it was supposed to be locally unfossiliferous.

The locality from which the species herein described were obtained, was examined by Mr. D. B. Dowling in the summer of 1889, while acting as the writer's assistant on the Geological Survey of North-Western Manitoba. It is situated on the south side of the gorge of Bell River, in the eastern face of Porcupine Mountain, and is near the extreme north-western corner of Manitoba, in north latitude 52° 35′, west longitude 101° 8′.

The trail followed by Mr. Dowling in exploring Bell River led from Swan Lake to the summit of Porcupine Mountain, and on this course none of the lower divisions of the Cretaceous series were exposed. At an elevation of 1,450 feet above the sea on the north side of the river a somewhat slidden hillside shows, to a height of thirty feet, a scarped face of dark grey clay shales, representing a horizon very near the base of the Pierre formation. Thirty-five feet higher up the bank, and on the south side of the river, is an outcrop of light grey hard siliceous clay shale, associated with a few dark nodules of ironstone. Specimens of this shale were collected and brought to the Museum of the Geological Survey at Ottawa, and on being submitted to a microscopical examination were found to contain large numbers of well-preserved Radiolaria, preliminary notes of the occurrence of which were published in the American Journal of Science and Arts for September, 1890, page 230, and in the Transactions of the Royal Society of Canada, 1890, Section IV, page 113.

Immediately on learning of the discovery, Dr. D. Rüst, of Hanover, Germany, the most noted living authority on these minute fossil forms, kindly consented to examine and determine any species that he might be able to find in this clay shale, and the following report is the result of his labours.

Above this outcrop of Radiolarian shale no exposures of rock in place were seen, but the position assigned to it, near the base of the Pierre, is believed, from the evidence of numerous other exposures, to be approximately correct.

J. B. TYRRELL.

Sub-class: SPUMELLARIA.

Order: **SPHÆROIDEA.**

Family: **Liosphærida,** Haeckel.

Sub-family: **Caryosphærida,** Haeckel.

Genus: **Caryosphæra,** Haeckel.

1. CARYOSPHÆRA ÆQUIDISTANS, n. sp.

Plate XIV., figs. 1*a* and 1*b*.

Shell composed of five concentric spheres, two medullary and three cortical, each with about equal radial proportions. All the spheres with regular circular pores, two to four times as wide as the bars, increasing in size from the centre towards the smooth surface.

Dimensions :—Diameter of the first medullary sphere, 0·042 mm.
" " second " 0·063 "
" " first cortical sphere, 0·085 "
" " second " 0·105 "
" " third " 0·127 "

Occurrence : very rare.

Order: **PRUNOIDEA.**

Family : **Ellipsida,** Haeckel.

Sub-family : **Cenellipsida,** Haeckel.

Genus : **Cenellipsis,** Haeckel.

2. CENELLIPSIS HEXAGONALIS, n. sp.

Plate XIV., fig. 2.

Ratio of the longer axis to the shorter 2 : 1. Pores regular, circular, about as wide as the bars, thirteen to fifteen on the half equator. The perimeter of a longitudinal section is roundish hexagonal. Surface smooth.

Dimensions : Longer axis of the ellipsoid, 0·26. mm.
Shorter " " 0·127 "
Pores " " 0·05 "

Occurrence : not frequent.

Family : **Druppulida,** Haeckel.

Genus : **Prunulum,** Haeckel.

3. PRUNULUM CALOCOCCUS, n. sp.

Plate XIV., fig. 3.

The ellipsoidal cortical shell thin-walled, smooth, with regular, circular, pores about as wide as the bars. Ratio of the major axis of the ellipsoid to the minor, 3 : 2. Both medullary shells large and spherical with large circular pores.

Dimensions : Major axis of cortical shell, 0·194 mm.
Minor " " 0·117 "
Diameter of the first medullary shell, 0·065 "
" " second (outermost) shell 0·08 "

Occurrence : rare.

Sub-class : NARSELLARIA.

Order : CYRTOIDIA.

Family : **Cyrtocalpida.**

Sub-family : **Archicorida.**

Genus : **Cyrtocalpis,** Haeckel.

4. CYRTOCALPIS CRASSITESTATA, n. sp.

Plate XIV., fig. 4.

Shell infundibuliform, very thick, with regular circular pores of equal size, and about as wide as the bars. Mouth large, simple, wider than the length of the shell. Surface smooth.

Dimensions :—Shell, 0·138 mm. long.
Mouth, 0·174 " wide.

Occurrence : not frequent.

Family : **Sethocyrtida.**

Sub-family : **Sethocorida,** Haeckel.

Genus : **Dictyocephalus,** Ehrenberg.

5. DICTYOCEPHALUS MICROSTOMA, n. sp.

Plate XIV., fig. 5.

Shell, thin-walled, smooth, collar stricture not apparent. Cephalis sub-spherical, hyaline, without pores. Thorax inflated sub-spherical, with regular circular pores, about as wide as the bars, in twenty oblique rows. Mouth constricted, only one-third as wide as the thorax, without peristome.

Dimensions:	Cephalis,	0·053	mm.	long.
	"	0·045	"	broad.
	Thorax,	0·151	"	long.
	"	0·147	"	broad.
	Mouth,	0·051	"	in diameter.

Occurrence: frequent.

6. Dictyocephalus macrostoma, n. sp.

Plate XV., fig. 1.

Shell thin-walled, smooth, without collar stricture. Cephalis subspherical, hyaline, without pores. Thorax, roundish urceolated with regular circular pores about as wide as the bars, in fifteen to sixteen oblique rows. Mouth less constricted than in the former species; two-thirds as wide as the thorax, without peristome.

Dimensions:	Cephalis,	0·051	mm.	long.
	"	0·042	"	broad.
	Thorax,	0·153	"	long.
	"	0·127	"	broad.
	Mouth,	0·083	"	in diameter.

Occurrence: very frequent.

Family: **Theocyrtida.**

Sub-family: **Theocorida.**

Genus: **Theocampe,** Haeckel.

7. Theocampe sphærocephala, n. sp.

Plate XV., fig. 2.

Shell wide bottle shaped, thin-walled, with two distinct strictures. Cephalis spherical, hyaline, without pores. Thorax campanulate, with three transverse rows of circular pores. Abdomen inflated with from eight to nine obliquely descending rows of circular pores. Mouth but little constricted, two-thirds as wide as the abdomen. Ratio of the three joints to each other; length, 1 : 2 : 4; breadth, 1 : 3 : 6.

Dimensions :—Cephalis, 0·027 mm. long and broad.
Thorax, 0·039 " long.
" 0·031 " broad.
All three joints, 0·190 " long.
Abdomen, 0·147 " broad.

Occurrence : not frequent.

Family : **Theocyrtida.**

Sub-family : **Theocapsida.**

Genus : **Tricolocapsa,** Haeckel.

8. TRICOLOCAPSA SALVA, Rüst.

Plate XV., fig. 3.

Theocapsa salva, Rüst, 1885. Palæontographica, Bd. xxxiv, p. 210, Taf. 28, fig. 5. Beitrage zur Kenntniss der fossilen Radiolarien in der Gesteinen der Kreide, von Dr. Rüst.

Shell slenderly ovate, with two slight strictures. Thorax of about the same size as the abdomen. Relative lengths of the three joints 1:3·5:4, relative breadth 1 : 3 : 3·5. Cephalis flat hemispherical, hyaline, without pores. Thorax spherical with subregular circular unequal pores. Abdomen broad ovate, with larger, regular, circular pores, in from nine to ten transverse rows. Surface smooth.

Dimensions :—Length of shell, 0·23 mm.
Breadth of abdomen, 0·127 "

Occurrence : frequent.

This species was first discovered in the Coprolites of the Gault near Zilli in Saxony, and described in Palæontographica, vol. xxxiv. The form there found is a little smaller, but is of very common occurrence.

9. TRICOLOCAPSA THORACICA, n. sp.

Plate XV., fig. 4.

Shell ovate, smooth, with two distinct strictures. Relative lengths of the three joints 2 : 5 : 3. Relative breadths 2 : 5 : 5. Cephalis hemispherical, with from three to four transverse rows of small circular pores. Thorax subspherical, with from nine to ten transverse rows of larger regular circular pores. Abdomen broad, hemispherical, with from four to five transverse rows of pores of the same size.

Dimensions :—Length of shell, 0·204 mm.
Breadth " 0·157 "

Occurrence : not frequent.

10. TRICOLOCAPSA DOWLINGI, n. sp.

Plate XV., fig. 5.

Shell ovate, smooth, with upper slight, and lower deep stricture Relative lengths of the three joints, 1 : 4 : 6 ; relative breadths, 1 : 3 : 5. Cephalis hemispherical, hyaline, without pores. Thorax quite spherical with from seven to eight oblique rows of large circular pores, twice as wide as the bars. Abdomen subspherical, compressed, with from ten to twelve transverse rows of distant smaller circular pores.

Dimensions :—Length of the shell, 0·214 mm.
Breadth of the abdomen, 0·147 „

Occurrence : not frequent.

11. TRICOLOCAPSA SELWYNI, n. sp.

Plate XV., fig. 6.

Shell wide, bottle-shaped, smooth, with two distinct strictures. Relative lengths of the three joints, 1 : 2 : 4. Relative breadths, 1 : 2·5 : 6. Cephalis small, ovate, hyaline, without pores. Thorax hemispherical, with four transverse rows of circular regular pores. Abdomen large, inflated, spherical, with from ten to twelve transverse rows of pores of equal size.

Dimensions :—Length of the shell 0·174 mm.
Breadth of the abdomen, 0·137 „

Occurrence : not rare.

Family : **Lithocampida.**

Sub-family : **Stichocorida,** Haeckel.

Genus : **Dictyomitra,** Ehrenberg.

12. DICTYOMITRA CANADENSIS, n. sp.

Plate XVI., fig. 1.

Shell short, conical, campanulate, smooth, with three distinct strictures. Cephalis small, spherical. Thorax small, hemispherical, with three transverse rows of circular pores. Abdomen with two joints ; the upper large, inflated, with eleven transverse rows of circular, regular pores ; the lower joint ring-shaped with four transverse rows of pores of the same size. The wide open mouth without peristome. Relative lengths of the four joints, 1 : 1 : 5 : 2. Relative breadths, 1 : 1·5 : 5 : 5·5.

Dimensions :—Length of the shell, 0·23 mn.
Greatest breadth, 0·147 „

Occurrence : not frequent.

13. DICTYOMITRA POLYPORA, Zittel.

Plate XVI., fig. 2

Dictyomitra polypora, Zittel, 1876. Zeitschrift der deutsch, geol. Gesellsch., Band 28, p. 80, Taf. II., fig. 1.

Shell slender, conical, rough, with six to nine deep strictures. Length and breadth of the joints gradually increasing, so that the eighth joint is twice as long and broad as the third. Pores regular, circular, in transverse rows in each joint, the last joint having from five to six rows.

Dimensions :—	Length of the shell (with eight joints),	0·24 mm.
	Length of the eighth joint,	0·04 "
	Breadth " " "	0·1 "
	Length of third joint,	0·02 "
	Breadth " "	0·05 "

Occurrence : frequent.

This species is likewise found in Secondary rocks of Northern Germany (Cretaceous chalk of Brunswick), Zittel ; in the Neocomian chalk of Gardenazza (St. Cassian), and the Gault Coprolites of Zilli (Saxony), Rüst.

14. DICTYOMITRA MULTICOSTATA, Zittel.

Plate XVI., fig. 3.

Dictyomitra multicostata, Zittel, 1876. Zeitschrift der deutsch. geol. Gesellsch., Band 28, p. 81, Taf. II., fig. 2–4.

Shell slender conical with prominent longitudinal ribs, and from eight to ten deep strictures. Length and breadth of the joints gradually increasing, the eighth joint being twice as long and broad as the fourth joint. Pores regular, circular, one series in each longitudinal furrow, three to four pores in each joint.

Dimensions :-	Length	of the	shell (with eight joints),	0·2 mm.
	"	"	fourth joint,	0·02 "
	"	"	eighth "	0·04 "
	Breath	"	fourth "	0·04 "
	"	"	eighth "	0·08 "

Occurrence : frequent.

This species is likewise found in Secondary rocks of North Germany (Chalk of Brunswick, &c.), Zittel.

Family [illegible].

Sub-family **Stichocapsida.**

Genus **Stichocapsa**, Haeckel.

[illegible] Stichocapsa [illegible], n. sp.

Plate [illegible], fig. [illegible].

Shell smooth, slender, pear-shaped, twice as long as broad, with three deep strictures. Relative lengths of the four joints [illegible]. Relative breadths [illegible]. Cephalis spherical, hyaline, without pores. Thorax hemispherical, with four transverse rows of regular circular pores. The fourth joint is the broadest, but is shorter than the large campanulate third joint. Pores in the second, third and fourth joints of equal size, and all about as wide as the bars.

Dimensions.—Length of the shell, [illegible] mm.
Breadth of the fourth joint, [illegible]

Occurrence.—Not rare.

[illegible] Stichocapsa [illegible], n. sp.

Plate [illegible], fig. [illegible].

Shell smooth, irregular ovate, with three internal septal rings, without external strictures. The third joint is the largest, being more than half as long as the shell. Relative lengths of the four joints [illegible]. Relative breadths [illegible]. Cephalis hemispherical, hyaline, without pores. The second and fourth joints small, with three transverse rows of regular circular pores. The third joint ovate, with [illegible] pores, and from twelve to thirteen transverse rows of sub-regular circular pores.

Dimensions.—Length of the shell, [illegible] mm.
Breadth of the third joint, [illegible]

Occurrence.—Not frequent.

PLATE XVI.

Page

Figs. [illegible] and [illegible]. [illegible] [illegible] [illegible]

Fig. [illegible]. [illegible] surface of uppermost shell.

" [illegible]. [illegible] [illegible] [illegible] [illegible]

" [illegible]. [illegible] [illegible] [illegible] [illegible]

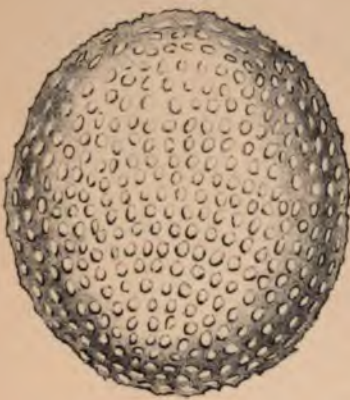
" [illegible]. [illegible] [illegible] [illegible] [illegible]

This figure is drawn from a specimen with the apex pointing obliquely downwards to show the wide mouth.

" [illegible]. [illegible] [illegible] [illegible] ... ... [illegible]

PLATE XIV.

1a.



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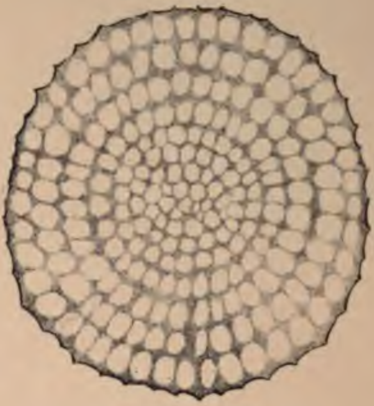

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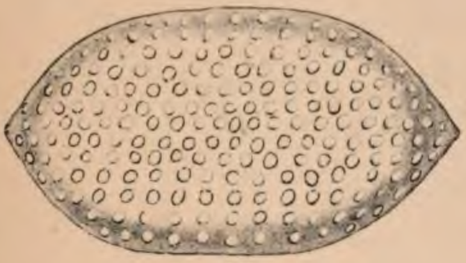

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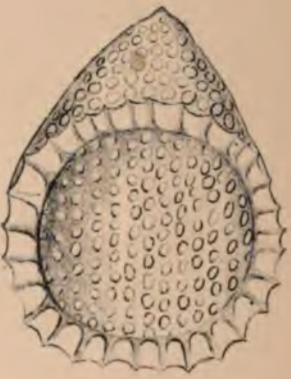

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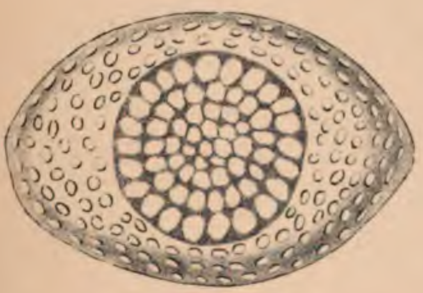

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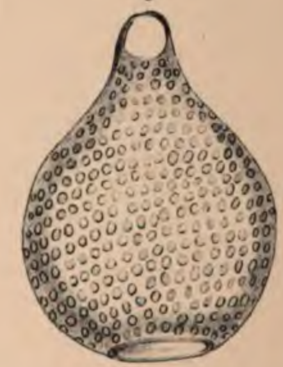

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PLATE XV.

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" 2.	*Theocampe sphaerocephala*	106
" 3.	*Tricolocapsa solea*	107
" 4.	*Tricolocapsa thoracica*	107
" 5.	*Tricolocapsa Dowlingi*	108
" 6.	*Tricolocapsa Selwyni*	108

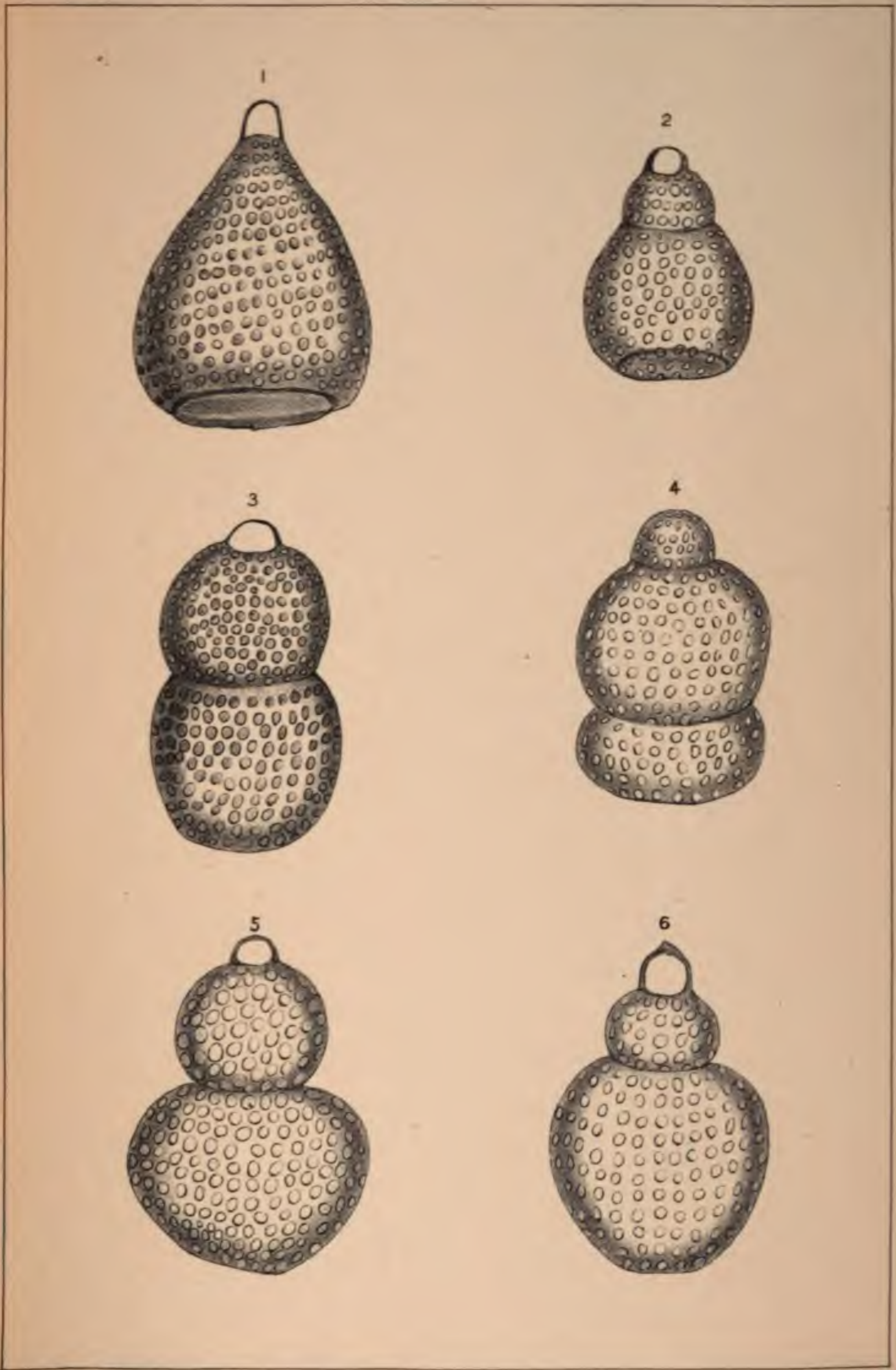

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PLATE XVI.

		PAGE.
Fig. 1.	*Dictyomitra Canadensis*	108
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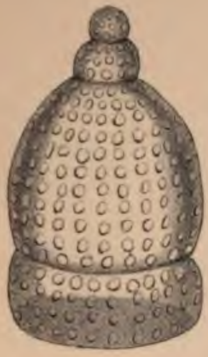
1



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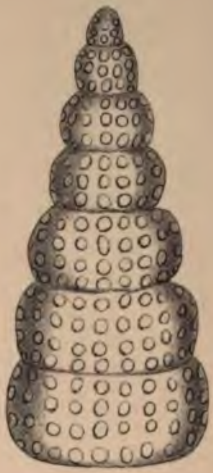

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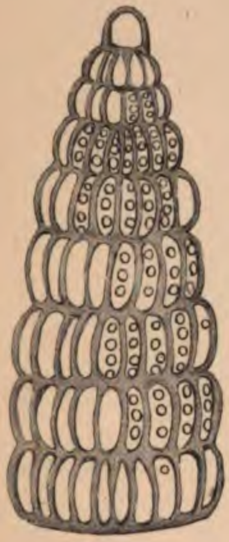

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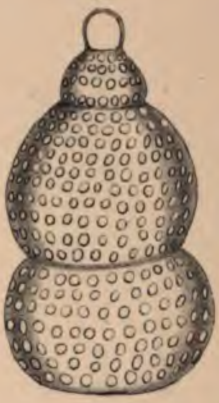

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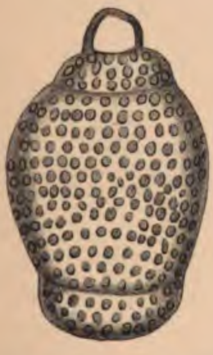

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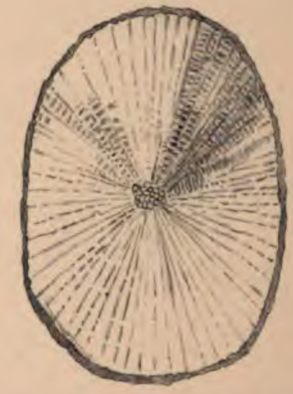

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